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THE

ELECTRICAL REVIEW.

VOL. LXXXIV. FEBRUARY 14, 1919. No. 2,151.

ELECTRICAL REVIEW.

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TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving his copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

THE ELECTRICAL STRIKE FIASCO.

THE threatened strike of the London Branch of the Electrical Trades Union, which was to have plunged London into darkness, last week, proved to be stillborn; of illegitimate conception, it had no right to be, and the darkness that was threatened never saw the light. From the moment that the Government declared itself upon the side of law and order, the result was not in doubt, and the only course left for the votaries of Anarchy was to find a way out of the *impasse* with the least loss of prestige—if the word can be used in such a connection. Let us clearly understand what it was all about.

On January 3rd the electrical workers in the London district were granted an award reducing the hours of work from 54 to 47 (or 56 to 48), without reduction of pay; and on January 23rd the National Joint Industrial Council for the Electrical Contracting Industry, meeting at Leeds, also adopted the 47-hour week for that branch of the industry, throughout the whole country. The threatened strike had nothing to do with either of these agreements. The reason given for striking was, in fact, entirely remote from the interests of the London electricians; it was a demand that the Government should intervene on behalf of the workers in the strikes at Belfast and on the Clyde, and should at once take steps to impose a 40-hour week on the whole country, in order to "absorb" unemployment. The strike leaders, therefore, took it upon themselves to throw out a challenge to the Government about a matter with which they had no concern, and sought to demonstrate the reality of the power which was their boast — that by stopping the supply of electricity in the metropolis they could compel the National Government to submit abjectly to their autocratic decrees.

It may be objected that the problem of unemployment was not without the scope of the Union's interests; but the contention is absurd. One of the leading promoters of the strike declared the other day that so short-handed was the electrical industry that 2,000 men could be set to work at once in London alone, and the reduction of the working hours in power stations would involve the employment of another 1,000 men, if they could be got. We know well that so many of the best of the electrical workers—the most highly skilled and capable men—enlisted in their country's service that for years past there has been a constant scarcity of skilled men, and the supply authorities and contractors have had to do the best they could by engaging any man who claimed to possess electrical knowledge. There is no lack of work for qualified electricians, and to mention unemployment in that connection is utter nonsense. Neither is there any scarcity of work for the engineering trades on the Clyde or at Belfast. The fact is that all these strikes, while parading under the cloak of solicitude for brother workmen, are based upon a common aim—a desire to overthrow the established order of things and to substitute the "reign" of Anarchy and social chaos. In a word, it is not philanthropy or altruism that actuates the agitators—it is Revolution that they seek; and what that means may be gathered from the hideous tales of immorality and lawlessness that come to us from Russia.

That was the real object of the strike—there was no unsettled grievance or outstanding dispute between employers and employed in the London district; not only had they come to terms on the subject of working hours and rates of pay, but they had set up, for the electricity supply systems, a standing conference on which both parties were represented, for the express purpose of settling differences—practically a Whitley Council—and a similar arrangement had been offered for the contracting industry. The strike was undertaken purely in order to further the revolutionary movement.

Let us now consider why it failed. First, as we have mentioned, the Government, under the Defence of the Realm Act, put in force a penal clause which ought to have been embodied in the Electric Lighting Acts in the first instance, as it already was in the Gas and Water enactments, and which imposed heavy liabilities upon any person whose actions menaced the continuity of supply of electricity as a branch of the public services; this regulation, no doubt, hampered the strike leaders by exposing them to instant arrest in the event of their taking any action contrary to the public interest. But would the fear of D.O.R.A. have daunted the electrical workers themselves, and prevented them from leaving their posts when called upon *for adequate reasons?* Not for a moment! The strike was a failure before it even began; it was broken by the loyalty and patriotism of the men themselves, who flatly refused to come out in such a cause, despite the efforts of their would-be leaders. We have stated on previous occasions that the members of the Electrical Trades Union are *not* disloyal or unpatriotic, and that the clique of mischief-makers who control the Union do not truly represent the men; and we have the greatest pleasure in stating that at meetings called by the shop stewards of the supply industry to consider the resolution of the London Executive Committee, the summons to strike was rejected by a majority of the order of 10 to 1. To put the matter in the plainest terms, the strike was prevented by the loyalty of the electrical workers of the supply undertakings. They were on thoroughly good terms with the employers; they saw no reason why they should be made to serve the political ends of a gang of revolutionaries; and they took a pride in their work—hence, almost without exception, they carried on, and we think they have well earned the gratitude of the community.

Next, let us consider what would have happened if the electrical workers had taken the opposite course. Directly the strike was announced, the Electrical Power Engineers' Association, composed of the technical staffs of the supply undertakings, declared its intention of maintaining the supply of electricity, with the aid of voluntary labour. To do this would have necessitated strenuous exertions on the part of the members, for obviously the employment of strangers, many of them entirely untrained and unskilled, would have involved incessant supervision and instruction, and would undoubtedly have cast a heavy burden on the shoulders of the engineers. But they expressed their determination to prevent the cessation of supply, and we may add that their words were translated into action, for very complete preparations were made for the feeding and resting of the staffs, while plans were made for the temporary reorganisation of the undertakings with a view to facilitating the work.

Moreover, the National Association of Supervising Electricians, comprising a body of men of first-class training and ability, offered the services of its members, to assist the station engineers, and the Association of Engineers-in-Charge, whose members also would have rendered invaluable assistance, came forward with a similar offer. Voluntary aid was tendered from a variety of other sources—many replies to our appeal for volunteers were received from readers, to whom we tender our cordial thanks—and, in fact, it was clear that there would be no lack of helpers. The E.P.E.A., we may add, had at the time important negotiations in progress with the employers throughout the country, which had reached an extremely critical stage, and no doubt the E.T.U. counted upon this fact to influence the Association in favour of the strike; but the Association deferred its private aims in view of the public need, and we feel that the thanks of the community should be accorded to the Electrical Power Engineers' Association, the Supervising Electricians, and the Engineers-in-Charge, as well as to the power station and other members of the E.T.U., for their loyal conduct and enlightened patriotism in the face of a national emergency.

What has been the result of it all? The strike has failed miserably; the vaunted power of the leaders of the E.T.U. has been shown to be an idle boast, and a victory, of which the importance can hardly be exaggerated, has been won by the forces of law and order. For what would have followed a successful strike? The capital, and the Government, would henceforth have been at the mercy of a coterie of irresponsible Bolshevists, and no limit could be set to the excesses to which this might have led. The danger was grave; we trust the lesson will be borne in mind by the Government, by the supply authorities, and by the leaders of the Electrical Trades Union.

We may add a word as to the ostensible object of the strike—the adoption of the 40-hour week. As we have pointed out above, this was not the real purpose of the movement; but suppose it had been: what then? The electrical industry, as already stated, had just agreed upon a working week of 47 or 48 hours, in place of 54 or 56, without reduction of pay, but the new arrangement had hardly come into force, and could not be said to have been tried—yet a proposal was put forward further to reduce the working week to 40 hours! We are not concerned here to discuss the subject from the social or ethical point of view, but solely from the industrial standpoint, and we would ask the members of all Trade Unions—and there are many connected with the electrical industries—whether it would not be wise to give a fair trial to the 47 hours first. The difference is considerable; it may involve a heavy addition to the cost of production, and therefore may impose a heavy handicap upon our national prosperity. We shall have very keen competition to meet, and heavy costs to bear; and the question must arise—Can we do this, and live? It is a very grave question indeed; it is not a matter of labour *versus* capital, or anything of that sort—it is a question whether the worker can *afford* to shorten his hours of work. Output is the key to employment and prosperity; beware lest that key be lost!

As regards the general aspect of the question, it appears to us exceedingly regrettable that, at a time when every ounce of strength that we possess ought to be devoted to the restoration of our industries, our energies should be sapped by these senseless strikes, which, while nominally intended to reduce unemployment, in fact continually and inevitably tend to its increase. A very gratifying feature was the absolute unanimity with which the lay Press condemned the strikes on the one hand, and whole-heartedly supported the Government and the supply authorities and railway management on the other. The maintenance of the public services—lighting, power, and transport—is vital, not only to the well-being, but also to the safety of the residents in the whole of the Metropolitan area, and it is deplorable that the interests of some seven million persons should be at the mercy of a few persons who are devoid of patriotism, humanity, and common-sense. The strikes were denounced by the recognised leaders of the Trade Unions, and the least penalty that should be imposed upon the strike leaders ought to be suspension by the National Executives *sine die*.

Excess Profits and the Law of Rating.

We happen to know of at least one electric lighting undertaking which is in the fortunate—or unfortunate—position of having to pay Excess Profits Duty. Some of our readers will, therefore, note with interest a recent decision of the King's Bench Division in relation to this heavy tax.

It arose in connection with the law of rating. Rates are based upon the rental value of property, and in the case of an ordinary house the rateable value is comparatively easy to arrive at. But when the rates which have to be paid by a gas or electric lighting company fall to be assessed, how is rental value to be ascertained? To solve the problem the lawyers rear up a dummy known as the hypothetical tenant, and they then set themselves to ascertain, by the application of divers rules, what rent he would pay—"On a tenancy from year to year, free of all usual tenants' rates and taxes, and deducting the average annual cost of repairs, insurance, and other expenses necessary to maintain the hereditament in a state to command the rent." Who, in his senses, would "rent" an electric lighting undertaking? No one but a hypothetical tenant. What rent would he pay? That is the question which the rating authorities have

to solve, and to do it they have regard to profits. The question for the King's Bench was: "Is Excess Profits Duty to be regarded as part of the profits?" The judges have answered the question in the affirmative, and have held that in arriving at the rateable value of premises in which a business liable to the payment of Excess Profits Duty is carried on, the liability to such duty may be taken into account. This is an interesting decision, because, strange to say, the view generally held by rating authorities is that income-tax ought not to be taken into account. There is no definite decision on this point, and as there is very little distinction (at any rate, to the mere lay mind) between income-tax and Excess Profits Duty, some electric lighting company which pays income-tax may think it worth while to raise the question on its new assessment.

National Electricity Supply.

The report of the Association of Municipal Corporations on this subject, from which we give extracts elsewhere in this issue, generally endorses the main principles formulated by the Board of Trade Committee on Electric Power Supply, and approves of the proposal to give the Commissioners a free hand to deal with each district in accordance with local conditions. While it makes no demand for the exclusion of company representatives, it claims for the municipalities a preponderating voice, as might be anticipated, and condemns the suggestion that the operation of a district undertaking might be leased to a company. The right of a municipal corporation already supplying power on a large scale to continue and develop the supply, at its own risk, is upheld, with the proviso that its area shall be extended in accordance with the requirements of the district; this meets the point which we raised some time ago, when we urged that if a large municipal undertaking were authorised to carry on, it must not be allowed thereby to prejudice the interests of small neighbouring communities which would stand to gain by the pooling of the areas in the hands of a District Board.

With regard to the financial proposals, the Association naturally objects to the terms suggested by the Committee, which cannot be regarded as satisfactory; the principles which the former puts forward as fair bases for the transaction appear to be unexceptionable, and the Association wisely leaves their application to the discretion of the Commissioners in each case; but we consider that provision should be made to carry the matter to arbitration if either party so desires.

On the whole, the report is moderate and judicial; while, of course, it leans towards the municipal side of the question, it is free from the extravagances which disfigured previous municipal reports on this subject, and from the reactionary tendencies of others. A notable omission, which we observe with regret, is that of reference to the compensation due to officials who may be displaced by the operation of the scheme. Such compensation ought to be made compulsory, on definite lines. But it is no new thing for municipalities to ignore their obligations to their servants.

National Industrial Council for the Electric Supply Industry.

In a recent issue we commented on the proposal which is at the present moment before the electric supply industry to form a National Industrial Council on the lines of the Whitley Report. The reason for forming Industrial Councils is that it seems to be the one possible method of superimposing some sort of order upon the interminable labour disputes which are coming up every day. So far as the electrical industry is concerned, there would appear to be the most pressing reason for an Industrial Council to be formed. The industry is a "key" industry to a large section of the industrial world, and, obviously, may be also a "key" industry to the Trade Union world. As such it is in a particularly vulnerable position, and Trade Unions which have nothing to do with electricity supply might readily bring about a strike in the supply industry as a way to bring the country to heel in respect of their own grievances. In addition to this, there is the possibility of the "strike" being used for political purposes, which we have recently seen exemplified both in the Provinces and in London, and in this case the electricity supply industry would evidently be the most useful cats-paw. It is obvious, of course, that the National Industrial Council could not directly deal with these extraneous dangers, but if the industry itself was satisfied, and there was confidence and close co-operation between both parties inside the industry itself, the danger of the industry being used as a tool by other parties would be reduced to a minimum.

At present the whole scheme of these Industrial Councils is on an entirely voluntary basis. There appears to be, however, a great likelihood of pressure being brought upon the Government to compel it to give a legislative standing to these Councils and a legal effect to their decisions. As showing the trend of opinion, we may quote the *Daily Mail* of February 3rd, where it suggests that "the National Joint Standing Committees recommended under the Whitley scheme should be compulsorily established, and the suggested law to give them powers of adjusting hours and wages should be passed without delay"; and in a previous issue it is premised that "the sooner the Government establish these Councils with full powers, the sooner are we likely to substitute peace by negotiation for the present ruinous guerrilla warfare"—important facts which should be given full consideration by the electricity supply industry in deciding on this momentous question.

The "Electrical Review" (Limited).

Our readers will have noticed that recently the familiar style of the firm of "H. Alabaster, Gatehouse & Kempe" has been replaced by the title at the head of this paragraph, and may have been led to speculate upon the reason for the change. In point of fact, it is a very simple matter—a change in form but not in substance, for the identity of the proprietors remains exactly the same as before. The registration of the firm as a limited company was found to be desirable for purely private and personal reasons, related to the technicalities of partnership and company law, and, apart from the change of style, it will make no difference in any respect to the conduct of the journal.

It is not without a sense of pride and satisfaction that the proprietors look back over the long period during which their names have been associated with the Electrical Review. Inaugurated as a monthly journal on Nov. 15th, 1872, it was published bi-weekly six months later, and after a few years it became a weekly paper; from its first appearance to the present day, it has never missed an issue, and, as the late Sir William Preece remarked, in congratulating it on its fortieth birthday, the files of the journal form a "complete historical record, not only of the growth of the practical applications of electricity, but of the science itself on which these industries are based." Founded in the same year as the Society of Telegraph Engineers, which is now the Institution of Electrical Engineers, the Electrical Review has enjoyed the rare privilege of recording contemporaneously the marvellous developments which have taken place in every branch of electrical science, of which the resources seem to be inexhaustible, and throughout by far the greater portion of its existence the journal has been in the hands of the same proprietors, and has maintained unchallenged its position as the organ of the British electrical industries.

During the past four years we have had many difficulties to contend with; in some respects these still continue to handicap our efforts to cope with the mass of information that we wish to lay before our readers, but as time goes on we have no doubt that normal conditions will return and we shall be free to develop our plans for improvement in the efficiency and usefulness of our pages. In the meantime, the tide is already flowing strongly in our favour—our circulation is advancing at a rate unprecedented in our experience, and we discern in this an indication that a period of intense activity in the electrical industries is about to dawn. We trust that the internal economy of the industrial organisation of this country will soon be freed from the disturbances which at present hamper progress, and that all ranks and classes throughout the industry will enjoy many years of unbroken prosperity.

THE MEASUREMENT OF MAXIMUM DEMAND.

By C. W. MARSHALL.

AMERICAN journals have given considerable attention to the question of the determination of the "maximum demand" on a circuit, and it is thought that the time may be opportune for a few notes on the subject from a British standpoint.

This article deals only with the "kilowatt" demand, as the problem of measuring the K.V.A. demand, in spite of its importance, has not as yet been considered very thoroughly.

Where the information required is the maximum number of B.O.T. units consumed in a given time, without reference to the time of day or night at which this maximum occurs, it can easily be obtained by the Merz maximum-demand indicator, the construction and working principle of which instrument is well known, and need not be gone into here.

To obtain the time at which the maximum occurs, entails the use of much more complicated apparatus, and, so far as the writer knows, the only commercial instrument on the British market for this purpose is the British Westinghouse printometer. This instrument gives a printed record of the essential figures of the meter reading for each half-hour

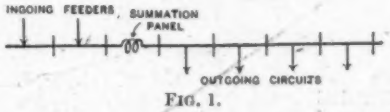


FIG. 1.

or hour. From this record the amount and time of the maximum demand can be obtained. The chief disadvantage of the system lies in the large amount of labour involved in working out the results. The performance of the meter on light loads, on 25 cycles per second at least, is also disappointing. The latter defect is very important in cases where it is a question of determining the aggregate maximum of a number of circuits whose individual consumptions are being measured by printometers.

This problem of determining the aggregate demand of a number of circuits is one which deserves close attention. Where it is possible to have a summation panel, as in fig. 1, there is no difficulty from a measuring standpoint, but the switchboard arrangement is not convenient for cleaning or extending.

On A.C. circuits,* as an alternative to the arrangement of fig. 1, the summation can be done on the secondary side of the current transformers of the branch circuits. This method is exemplified by a simple case, as shown in fig. 2.

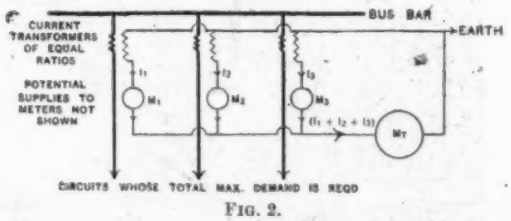

BUS BAR
EARTH
CURRENT TRANSFORMERS OF EQUAL RATIOS
POTENTIAL SUPPLIES TO METERS NOT SHOWN
CIRCUITS WHOSE TOTAL MAX. DEMAND IS REQD

FIG. 2.

In this figure meters M_1, M_2 and M_3 measure the individual supplies, while M_T measures the total supply. The potential circuits are not shown, for the sake of clearness, but, in general, all meters would be supplied from a common source. The summation meter in the case shown would be geared for the same current-transformer ratio as the subsidiary meters, and its current coils would be of sufficient capacity to carry the sum of the currents in the subsidiary circuits.

In most cases, the capacities of the individual circuits are not all alike, and, accordingly, current transformers of various ratios are used. No hard and fast rules can be established, but two methods which have proved useful will help to show how such problems may be attacked. The examples shown are taken from practice.

In fig. 3 $M_1 \ldots M_5$ represent the meters used to measure the outputs on the individual circuits, the current transformers in 1, 2, and 3 having a ratio of 100/5, while those in 4 and 5 have a ratio of 50/5. To obtain the maximum demand a special two-element meter M_T is used, connected as shown in the diagram. Element A has a current element wound for 15 amperes, while B has one for 10 amperes. The elements A and B are wound so that with the same power in each secondary circuit A produces twice the torque of B. In the above case, it was possible to adapt an ordinary polyphase meter for use as a summation meter, but in many instances it would be necessary to make up special meters. In America meter manufacturers have developed such meters to a considerable extent, and at least one 30-element meter is in use. So far as the writer knows, the Aron Co. is the only British firm which has studied the question of multiple

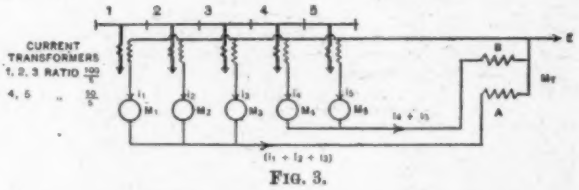
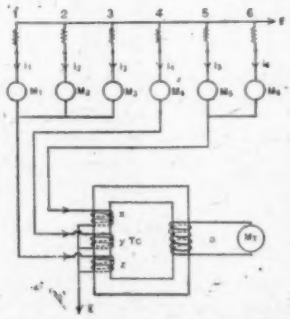


FIG. 3.

meters. This firm has built meters comprising five standard clock-meter elements with a summation counter and demand indicator.

It is generally advisable to avoid the use of non-standard meters, and this can be done by using multiple-primary current transformers to supply the summation meter. The scheme outlined in fig. 4 gives an example of this type, where the principle had to be applied to some very old apparatus. The drawback of this system lies in the fact that it is difficult to avoid circulating currents, due to the rather high impedance of the summation current transformer and the unequal loading of the various circuits.



Current transformers, ratio 1/6.
1, 2, 3 " 600/5.
4 " 400/5.
5, 6 " 300/5.
T_C = summation current transformer.
Primary windings = x, y, z,
x has n turns to carry 10 amperes.
y " $4n/3$ " " " 5 "
z " $2n$ " " " 15 "
Secondary winding = a.
a has $28\ n/3$ turns to carry 5 amperes.
(Secondaries of current transformers only shown.)

FIG. 4.

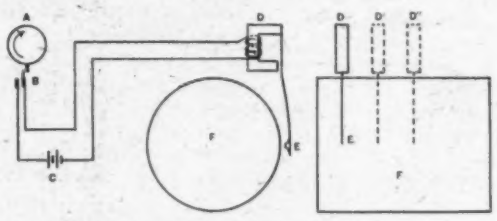
It will be noticed that the primary turns of the various sections of the summation transformer are proportional to the transformation ratios of the various branch circuits 1 to 6.

The methods mentioned above are suitable only for A.C. circuits where the distance between the branches is not great. Where D.C. or widely separated A.C. circuits are

* For the sake of simplicity, one phase only of each circuit is shown in the diagrams, but the extension of the system to polyphase work is obvious.

concerned, another method has been successfully used. The method is illustrated by a practical example, but the principle involved is quite general in its application. An ordinary meter is installed in each branch circuit, and each meter is fitted with a contact maker, which closes an auxiliary circuit whenever a predetermined consumption, say, 10 KW.-hours, has been registered. The auxiliary circuit is used to operate a relay on the special instrument used for recording the maximum demand. The recorder is of the simplest possible form, and it is presumed that its action will be clear from the accompanying sketch, fig. 5. This figure shows complete connections for one meter, and indicates how extensions for further circuits can be made.

The record obtained from the simple form of instrument shown in the figure consists of a succession of dots; the



A = Wheel in meter (1 rev. = 10 units).
B = Contact maker closed by projection on A.
C = Battery or other source of current for electromagnet D.
D = Electromagnet for pressing pen E on to drum F once every revolution of A.
D', D'' = Additional electromagnets for extra circuits.

FIG. 5.

distance between successive dots on any line is inversely proportional to the power, or the number of spaces per hour is directly proportional to it.

A sample chart is reproduced below (fig. 6). The unimportant parts of the day are omitted :—

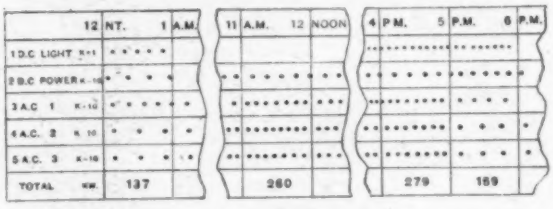


FIG. 6.

Where K = 1, each space (between two dots) represents 1 unit, and where K = 10 each space represents 10 units.

The load curve of the installation can be plotted from the above chart, and then the maximum demand can be found by making accurate estimates of the load at hours determined from the curve.

In important cases, it is better to use a fast recorder—say, 6 in. per hour—of the continuous roll chart type, so as to obtain high accuracy.

All the measuring systems mentioned in this article have been used in commercial installations for several years, and very little trouble from a mechanical standpoint has been experienced; they have given consistent and fairly accurate results during that period. It should, however, be borne in mind by engineers, when they are making agreements with clients, that in order to get the best results it is necessary to make proper provision for measurements from the start. They cannot reasonably expect meter men to make precision measurements on installations which have been designed by men who have not the remotest idea of the difficulties involved in determining accurately the data on which their costs so largely depend.

Sheffield Industrial Developments.—The Sheffield Corporation has set up a Development Department for encouraging new commercial and industrial businesses in the district.

ELECTRIC FURNACES IN THE LABORATORY.

By G. C. CASTLE.

A GREAT deal has been heard during the period of the war of electric furnaces as used for the manufacture of steels, ferro alloys, calcium carbide, carborundum, and other similar materials.

A new era has been brought about, also, in the last few

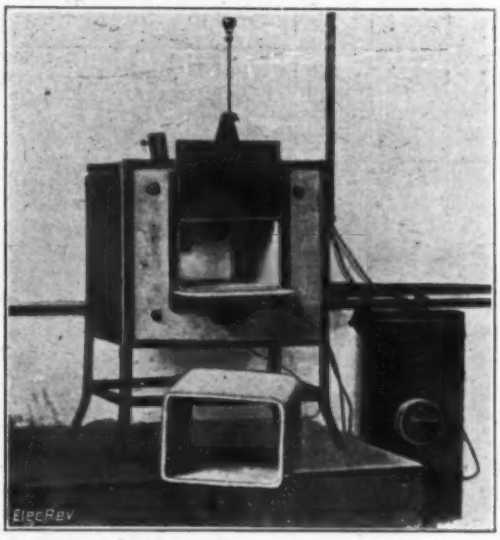


FIG. 1.—LABORATORY MUFFLE FURNACE.

years by the use of electric furnaces in the laboratory, but little has been written upon the subject.

These furnaces are constructed on the resistance principle, and the two general types used in the metallurgical department of the works are the muffle and combustion furnaces, as shown in the accompanying illustrations, figs. 1 and 2.

In the writer's opinion, they show superiority over gas furnaces in every respect. They are clean, and easily port-

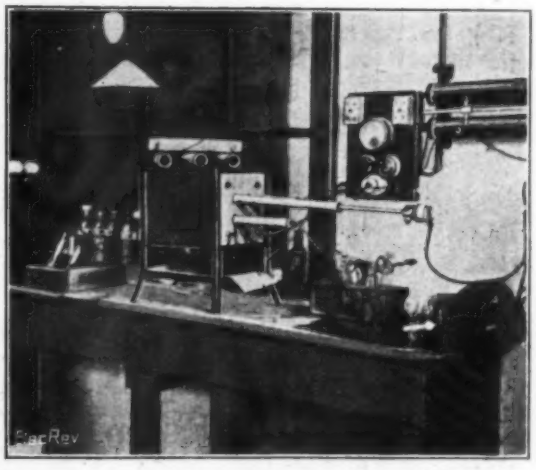


FIG. 2.—COMBUSTION FURNACE.

able. The consumption of energy is, of course, regulated by the size of the furnace, but a fairly large furnace, such as one of those reproduced herewith, consumes at its maximum approximately 10 amperes, which will give a temperature of about 1,850° F. A temperature higher than this is rarely required in a laboratory. The cost of energy used, say, for a 10-hour working day, per month, for the two types of

furnaces, runs at something like £1 10s. when the cost of energy per unit is moderately high.

The benefits obtained by the use of these furnaces are :—

They are very durable.

They need very little repair.

They radiate very little heat, and thus do not appreciably affect the atmospheric temperature in a small laboratory.

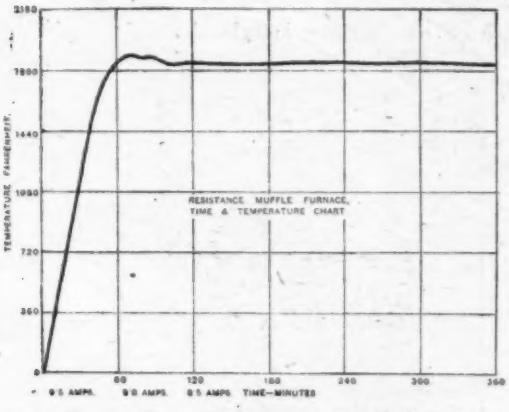


Fig. 3.—Time and Temperature Chart.

They quickly reach the maximum temperature and maintain it constant for an indefinite period, provided the voltage does not fluctuate. This is shown by the accompanying time and temperature charts.

The applications of these furnaces to general analysis and research work are very varied, and the writer has been able to use the muffle furnace for the following purposes :—

Research on heat treatment, in which the muffle is indispensable.

Fusions.

Rapid incinerations.

The combustion type is, of course, used for the estimation of carbon in materials, and it gives very accurate and

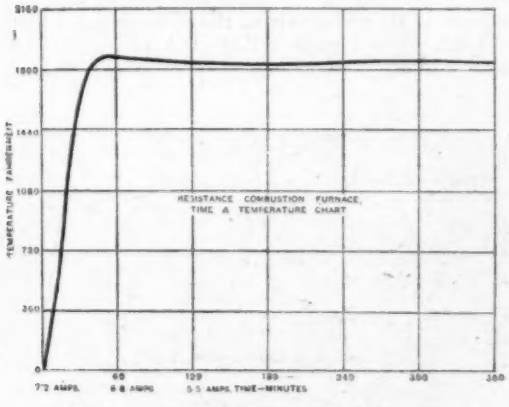


Fig. 4.—Time and Temperature Chart.

reliable results. It enables 50 estimations of carbon in steels to be accomplished in eight hours, using a four-tube furnace.

The initial cost of these furnaces is very little more than that of gas furnaces of the same size, and the reduced running expenses prove them to be a good investment.

The Metric System.—It is again announced that the Russian Government has decided to introduce the metric system of weights and measures, and all traders will be required to quote their prices in future in both the old and the metric system. It is expected that the new system will be adopted throughout Russia by the end of next August, and it is understood that from the end of 1924 the use of the old system will be prohibited in that country.

SCIENTIFIC MANAGEMENT FACTORS.

By Major E. A. Pells, R.E.

Management has been described as the function of handling human nature in conjunction with machines and materials, and "scientific management" may be described in brief as the efficient inter-relation for the purposes of production of men, minutes, and materials.

In all branches of scientific research, definite factors have a certain and definite effect on the ultimate result, and (1) whereas some may be ignored for all practical purposes ; (2) yet others are of such paramount importance that not only must they be very carefully studied, but they must be reduced to very accurate values ; (3) again, others are of such a variable character that no fixed value can be placed on them, and everything then depends on the ability and experience of the experimenter or the calculator. In considering our management factors, let us take that which, in my opinion, is most important—namely, "men." Of course, when I speak of men, in these days of emancipation, I mean to include women as well. Now, in dealing with this factor, we are dealing with one of those which come under the heading (3), and it is often of such diverse values that it is difficult to bring its value into concrete form. We have, in considering this factor, very often a very interesting psychological study, as individual ability, energy, industry, reliability, temper—all have various effects on the final value. Regarding these individual characteristics, we find that ability can be improved by careful and systematised training and tuition ; energy may be improved by good feeding at regular hours and carefully-arranged rest periods, according to the demands of the work in hand ; industry can be improved by equitable wage systems, with an incentive ; reliability presents more difficulties than the foregoing, but by careful inspection of work even that may be improved. Having improved the other characteristics, it usually follows that the greatly-improved conditions and environment automatically produce a more equable temper.

There is no doubt that this human factor is one of great importance, and cannot be ignored, as many short-sighted employers have ignored it when introducing efficiency systems into their businesses. Flesh and blood can never be treated as machinery, however you systematise the work they have to do ; there always remain the idiocyncracies of the human which constitute such an interesting study for the student of psychology and efficiency engineers.

Now let us consider "Minutes." These come under the heading (2). They constitute a factor which must be most carefully observed and valued, as, unless this is done, the rest of the efficiency studies are likely to become absolutely valueless. Waste time must be closely studied and all unnecessary waste eliminated, whilst proper rest periods must be planned. Then this factor, carefully reduced to its correct value, may be used in the compilation of standards, which are the bases upon which all efficiency work must necessarily rest.

Coming next to "Machines," this is the widest of all factors, comes under heading (2), and embraces everything of a mechanical nature with which the worker labours. Unless you provide your worker with the most efficient tools wherewith to do his work, you cannot expect good results. It is often said that the bad workman always grumbles at his tools ; this may be so, but it is also true that many good workmen are frightfully handicapped, and never have an opportunity of showing what they can really do. There are many what may be termed "sub-factors" which crop up under this heading. The situation of the works in relation to the workers' homes is of importance, and this has been recognised by certain well-known motor, cocoa, and soap manufacturers who have built model villages for their employés, thus killing several birds with one stone, as the scheme for the betterment of their home lives and environment has resulted in better health of the workers and a finer and more sympathetic feeling between employer and employé. Where workers have to journey some distance from and to their work the consequent fatigue shows most distinctly in the results of their work; also we must add very often the fact of

the crowded character of their tenements and small houses resulting in ill-health and lack of energy.

Works layout and route is another sub-factor of prime importance, as a great deal of duplicate handling and congestion can be obviated by careful attention to this. Tools are in themselves the study of a lifetime; finality is never reached; material used in the manufacture, method of making, shape, system of issue to workers, are all things requiring a great deal of study and research to arrive at the best values. Machines themselves must be studied as to the best method of drive, speed, possible mode of application, and maintenance periods. The question of power supply is a matter needing careful consideration and calculation to decide whether to install one's own power plant or take a supply from a power company. Finally, we have the question of control. The old idea was a kind of "human driver"; but the newer ideas accentuate the value of the square deal for all men as the first control factor of all. F. W. Taylor advocated functional foremen, and he is very sound in his theory; but for the questions of shop discipline, a kind of court of inquiry of the offenders' co-workers is a very fine idea, and has given excellent results.

Under the various headings touched upon, many minor factors occur, and it is only by hard experience that the efficiency engineer will know when he may treat any one of them as coming under heading (1).

In "Scientific Management," as in any other science, it is not advisable to cast out any factor until you have proved that it is of no practical value in the equation under study.

In this brief *résumé* of a great subject I have touched lightly on many things, and my advice to any man who wishes to become a manager or a ruler among men is to carefully study his fellow-men, for a manager who ignores the human factor is a fool!

TESTING TRANSFORMER OILS.

In a paper read at a meeting of the London Section of the Society of Chemical Industry on January 6th, Mr. Arnold Philip, the Admiralty Chemist at Portsmouth Dockyard, gave an account of some work that had been done there to estimate the small percentages of water in oils used for transformer purposes. When working at very high voltages, such as those used in wireless telegraphy, serious troubles occur through the sludging of the oil. That question, the author said, had for some years been under investigation by a Committee of the Institution of Electrical Engineers, but probably due to the war that work of the Committee had been delayed. At the same time, another cause put forward to explain the delay in the work of the Committee was that there was no means of determining the amount of water in the mineral oils used for these purposes. It was known, however, that the most minute quantities of water had a serious effect on the insulation resistance of the oils, and also on the hysteresis of the oils at high frequencies, the quantities of water producing these effects being as low as .02 to .04 per cent. At Portsmouth, in connection with oils for transformers used in wireless telegraphy, they had gone into this matter, and had succeeded in devising methods which appeared to be in every way satisfactory. It had been suspected that there was more than one cause of the formation of moisture in oils, but during his experiments it had not been found possible to separate out the various causes on account of the quantities being so minute. The method which he had used was to pass a stream of air, under a pressure of 20 to 30 in. of mercury, in very fine bubbles through, say, 2 gallons of oil, the rate being about two or three bubbles per second. The oil was heated to about 100 deg. C. The air was sucked through the oil in this fine stream, and then passed through glass U tubes which were immersed in a cooling mixture of ice and hydrochloric acid, which gave a temperature of about .5 deg. F. That stream of air was passed through for about two hours, at the end of which time the U tubes were washed, dried, and weighed, and the weight of water was calculated. As an indication of the quantities of water found the following figures were given:—0.006, 0.014, 0.017, and 0.0074 gramme per 100 cc of oil. The last figure related to a sample of oil required for the wireless telegraph installation at Portsmouth. That particular oil was required to stand a test of 12,000 volts, but as supplied it withstood 22,000 volts before breaking down. After determining and removing the moisture in it, the break-down voltage was raised to 26,000. This indicated that these minute quantities of water did have a serious effect upon the insulation resistance of oil. An interesting point in connection with that particular oil was that it was afterwards exposed in close proximity to water for 36 hours, but subsequent tests showed that it had not absorbed any moisture in that way. If it had, the quantity was too mall to be detected.

In the discussion which followed, Mr. N. A. Anfilogoff said that the quantities of moisture which had been detected at Portsmouth were so small that they might almost have been caused by the breath of the chemist who made the investigation. It appeared to him that oils might absorb much larger percentages of moisture when in use in the transformer than those which had been given in the paper as existing when the oils were purchased. He could produce oils which were perfectly dry, but he would not guarantee that they would remain dry after they had been put into the transformer.

Dr. Ormandy thought the author had proved the importance of detecting these small quantities of water by the instance he had quoted where the breakdown voltage had been increased from 22,000 to 28,000 after the moisture had been removed. He would like to know if the oils which the author used were a particular type of paraffin oil, and whether he had distilled any of the heavy boiling oils of the coal-tar series. Further, had any experiments been made in the converse direction, viz., to extract small quantities of oil from water, using similar methods to those mentioned in the paper, or was it possible to remove them by electrolysis?

Mr. G. L. Addenbrooke agreed that the question of small traces of water in transformer oils was important. Methods had been used by electrical engineers for many years to remove the water, such as by the use of fused sulphate of copper and also calcium carbide, but these methods did not determine the amount of water present. It had been shown by Mr. Rayner, of the National Physical Laboratory, in a paper before the Physical Society, that water existed in oil in two states; it existed in an ionised form and also in the form of an emulsion. It was possible that a good deal of moisture could be taken out of oil by the use of an electric current, by attraction, and sometimes sparking was obtained from the globules of water and the electrodes. Certainly the disturbance which these minute quantities caused was astonishing. He was anxious to find out what the exact proportions of water in oils really were, because it was quite clear that the state of the oils changed considerably even during testing. A year or two before the war, the Reichsanstalt published some figures which were of the same order as those given in the paper.

Dr. R. Lessing asked whether an inert gas had been used instead of air. If nitrogen or CO_2 were used, it might exclude the possibility of oxidation during the test. There might be an oxidation taking place in the oil itself in the absence of moisture which would produce results such as those found by the author.

Mr. Neville Huntley said the design of apparatus used did not appeal to him. He had seen a good many tests made by it, but it was liable to be contaminated during the test; indeed, he believed that had been the case.

Mr. E. L. Lomax thought there was some misapprehension on this question of moisture in oil. It was quite possible to get oils perfectly free from moisture in the refining and sent out in that state. He did not believe an oil absorbed so much moisture as to affect its electrical properties, and the results which had been noticed by the author were probably due to unsaturated hydrocarbons, which were easily broken up by high-tension currents.

Mr. T. H. Durrans asked why water was estimated by freezing in favour of using a drying agent. Was it because the former method would detect also any other volatile constituents that might be present?

Mr. Philip, replying to the discussion, said that although the actual quantities of water shown by the experiments were small, in practice they were not inconsiderable, whilst the effect had been shown in the particular case he had mentioned where the voltage had been increased from 22,000 to 28,000. The reason why freezing was adopted was because this method would detect any other constituents, as mentioned. He was unable to answer Dr. Lessing as to the use of an inert gas, whilst as to a possible oxidation in the absence of moisture, he could only refer to the improvement in the electrical properties of oils after the moisture had been removed, which he had already mentioned. As to the absorption of moisture by the oil whilst in the transformer, to which reference had been made by Mr. Anfilogoff, only a very small area was left exposed at the neck, in order to reduce this possibility. The oil which he experimented with was a pure mineral oil. He had not tried the removal of oil from water by electrolytic methods, as suggested by Dr. Ormandy, although he had tried the removal of water from oil, and had obtained extremely concordant results on repeating tests on the same oil.

Electric Coal Cutters.—The number of electrically-driven coal-cutting machines in use in this country at the end of 1917 was, according to the *Engineer*, 1,739, an increase of 149 over the number in use at the end of 1916. The total horse-power of electric motors in use on the surface and underground was 913,640, of which 521,000 H.P. was in use underground.

IRON AND STEEL ELECTRIC FURNACES.

By J. BIBBY.

(*Abstract of paper read before the* MANCHESTER ASSOCIATION OF ENGINEERS.)

(*Concluded from page* 167.)

A furnace transformer system must finally be judged by its action under the fluctuating conditions inevitable in practice. If a rupture is caused in any one of the four arcs, it is interesting to see what effect this has on the currents in the primary mains; for example, arc No. 4, in fig. 3. In the vector diagram the sides of the heavy triangle represent the current in the three primary mains under this extreme condition. The currents are certainly out of balance, but for an extreme condition it is quite tolerable. There is also the possibility that one transformer for some reason or other

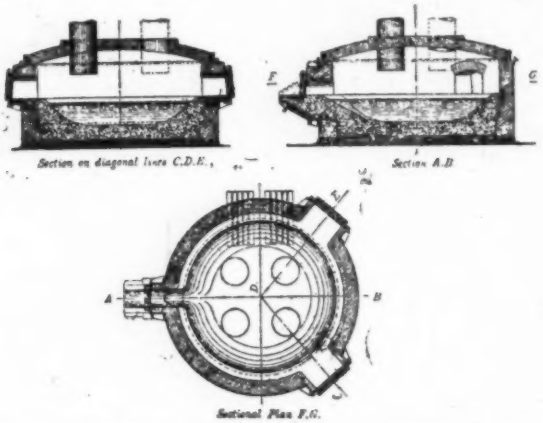


FIG. 4.—A 30-TON, 5,000-K.V.A., 4-PHASE ELECTRIC FURNACE.

may be put out of service, and the conditions are represented in the next diagram. In this case we get the two transformers overloaded, and currents in the primary mains represented by the sides of the heavy triangle. Again, the out of balance is not excessive and the power factor in each primary phase is high.

The largest furnace which is at present being built is of 30 tons capacity, 5,000 K.V.A., on the four-phase system. The furnace is circular in plan, having four electrodes and three doors (fig. 4), one for pouring and two for charging, so arranged that the whole of the hearth can be surveyed and repaired if necessary between heats. The hearth is of dolomite mixed with dehydrated tar for binding purposes, and hot rammed into position. The hearth is supported on the bottom and sides by refractory bricks, the neutral conductors being fixed between the bottom course and the hearth. No conducting materials are fitted in the hearth since, owing to the low current density, the conductivity of the dolomite hearth is sufficient.

This feature is of importance, since it eliminates one possible source of trouble. The side walls and roof are of silica bricks. The four electrodes are supported from independent carriages which travel vertically on the masts, and are operated by electric motors, the direction of the motors being automatically controlled. The furnace is supported on rockers and tilted by means of an electric motor and thrust screw. The current is brought from the transformer terminals through flexible cables to copper plates on each electrode carriage, and thence to the electrode. The connection between the conductors and the electrodes is made in the manner shown in fig. 5.

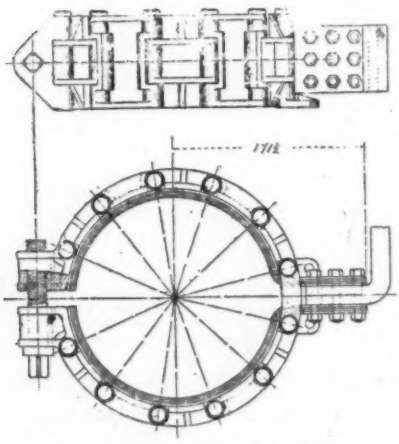


FIG. 5.—MANNER OF CONNECTING CONDUCTORS AND ELECTRODES.

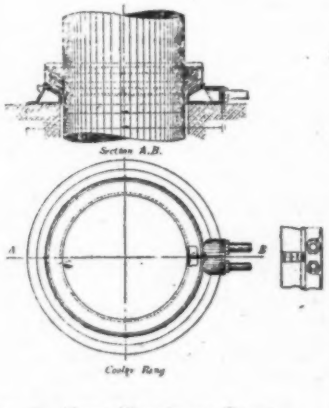


FIG. 6.—ROOF ELECTRODE GLAND.

To the main conductors are connected two semi-circles of laminated copper plates, bent to the circumference of the electrode. These laminated plates are pressed against the electrodes at 12 points by a chain system, consisting of links as shown. The terminal links are pulled together by the manual screw, and the laminated copper is pressed evenly against the electrode throughout the circumference. This clamp has proved very effective in practice, no appreciable heat taking place between the contact surfaces. One type of roof electrode gland which has given complete satisfaction is shown in fig. 6. With this gland the graphite electrode consumption is only about 10 lb. per ton of steel melted and refined. It consists of a circular water jacket with sloping outer surface on which rest a series of rings of oval section. These rings are in segments, and the edges gravitate to the surface of the electrode and thus kill the flame.

DISCUSSION AT MANCHESTER.

Mr. J. BUTTERWORTH, President of the Association, in the chair, remarked that steel smelting and refining furnaces were not extensively used in the Manchester district, and many of their members would have liked to hear more of a smaller type of furnace suitable for the production of small castings.

Mr. LANG said the paper was of great interest to the construction engineer who was anxious about his future sources of supply. It was probably necessary to bring about a universal system of production and distribution of electricity, upon which the future of electric steel and iron melting depended in this country. He gathered from the paper that if the electric furnace was to become a practical proposition in this country the cost of power must be reduced to a tenth of a penny, so there was a very long way to travel before the ordinary blast furnace would be supplanted. A good deal was made of the superior purity of electric steel, but experience in the war had taught experts to be rather more lenient in their views on the subject of sulphur and phosphorus, except in certain special cases. He agreed with Mr. Bibby in preferring the multiple arc as against the single arc furnace. The rôle of the latter was really confined to quite small production, and in particular to small foundry practice.

Mr. J. P. BENSON asked what the cost of energy was in the Italian furnaces, where it was produced by water-power.

Mr. BIBBY replied that it was about one-tenth of a penny, in some extreme cases it was one-twentieth. The countries where water-power was available had got a start in this matter, but it was satisfactory to find that immediately current could be procured at a reasonable price British engineers went ahead. Other countries came to England for their furnaces.

Mr. LEE asked whether trouble was anticipated from the graphite combine. It seemed to him that the carbon electrode would be very expensive to maintain, and it would not work very regularly.

Mr. WALKER inquired as to the kind of load that was obtained.

Mr. BIBBY replied that the load factor with the single furnace he took as being 30 per cent.; it depended on the number of furnaces in operation. The chief thing one wanted to know was the overload; they could take that as being about 50 per cent. The power factor varied from 70 to 80 per cent.

Mr. FOSTER said the presence of oxygen in cast-iron was undesirable; it was probably one of the greatest causes of unsound castings, but the matter had not been fully investigated. The electric furnace might help to solve that problem, and its use would be justified in cases where materials of special quality were required. When it was wanted in connection with an ordinary steel foundry the important question was the cost of the energy. Some information about the composition of the gases coming from the furnace would be desirable. It was not wise to attempt to get too much fuel value out of the gas, and in dealing with an output on a commercial scale the main consideration was not the quantity, but its thermal value measured by the heat it generated. Government experiments in the United States had shown that the rocking furnace gave excellent results with non-ferrous metals.

Mr. BIBBY, referring to the point at which it would pay to put down an electric furnace, said that it greatly depended upon the class of work. If small, delicate castings were to be produced a half-ton furnace would pay. Freedom from sulphur counted with small castings, because one did not get the sulphide eutectic; in cooling there were not the weak places or the small cracks which occurred with high sulphur pig-iron. In making tool steel it would pay to have

a furnace with power at 1d. per unit instead of the crucible. If large castings were in question, it would be possible to compete with the open-hearth furnace if the energy could be got at a fifth of a penny. The gas which circulated through the furnace could not be considered as playing any chemical part; it was there merely to convey the heat from the crucible to the upper parts. The voltage across the electrodes in the blast furnace varied from 35 to 70, and they had six tappings on the transformer. The steel furnace varied its heating surface by the amount of current; the blast furnace varied it by the voltage. He had investigated non-ferrous furnaces using an arc, and came to the conclusion that it was not the right principle for anything with zinc in it. Two furnaces were put down in this country—not a rocking furnace, but a similar type—where the heating was done by the radiation from the arc, and they both turned out heavy zinc losses. The latest report from America was that the rocking furnace had been used mainly for melting copper, not so much for yellow metal. He thought the non-ferrous problem would have to be solved by resistance furnaces, where the temperature could be kept down to just above the melting point of the ore.

Mr. J. Butterworth, the chairman, said he had thought of putting a furnace down at some time, but he had been advised by people in Sheffield not to do so; they considered it a most difficult and complicated trade. As a technical man, he was quite aware that there was a lot of truth in that statement; the difficulty was not in the casting alone, bu also in the melting. Owing to the great contraction met with in steel castings they were subject to "drawing." Manganese bronze was an analogous case; it was easy to melt, but very difficult to cast, and for that reason the price of the castings as compared with the price of the manganese ingots went up tremendously. He agreed with Mr. Foster that the presence of oxygen in cast-iron was very deleterious in foundry practice.

Mr. Gass said this ore reduction furnace had great possibilities if it could replace the ordinary blast furnace. Had anything been done in the way of melting of pig-iron in the electric furnace for the purpose of making castings?

Mr. Bibby: Yes! In France they are using the electric furnace in the form of an ordinary blast furnace for making some steel shell, and it is doing high-class work. With the electric furnace you have control of the temperature and of the atmosphere, so that you can refine the material to any degree required. For making special castings it has certainly a very wide field.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electric Pressure Regulation.

In your issue of January 17th, Mr. Kimmins mentions the difficulty of automatically governing the voltage of a dynamo run by a water turbine. What happens appears to be something like this:—

When the turbine speed increases, the automatic regulator weakens the field. This reduces the torque, and this in time causes the machine to run faster than ever.

Mr. Kimmins suggests that a very heavy fly-wheel might improve matters. There is, however, an alternative method which is worth trying, and that is to throw an artificial load on to the dynamo whenever its speed increases beyond a certain limit. The artificial load could consist either of a series of carbon plates, which could be brought into contact and put under pressure in the well-known manner, or a regulating resistance with a slider could also be used.

The artificial load would be worked by the turbine governor, and would be brought into action when the speed of the machine exceeded a certain limit. This would steady the turbine, and give time for the gates to be closed. As the speed settled down to normal the artificial load would be gradually cut out, and the voltage regulator would then take complete control.

C. Turnbull.

Electricity Works, North Shields,
February 4th, 1919.

"State Salary Expected."

On looking through the advertisements of "Situations Vacant" in the Review, one is struck by the very small proportion of those which state the remuneration.

In most cases the applicants are asked to state salary, &c. In your issue of January 31st I believe this is so in 87 cases out of a total of about 111. However, this number includes those for wiremen, armature winders, &c., whose rate is known approximately, but of the remainder there are some in which the possible remuneration may lie between limits which differ by several pounds per week. Again, some are so vaguely worded that it is very difficult to say exactly what sort of position is offered.

Why is it that employers and managers will not state the wages they are willing to give? Surely they are not out for the cheapest man who can be obtained? At any rate, the advertisers must know what they are prepared to give, and by stating the amount they would save many of us from wasting time on applications for positions which we either could not get or should not want, owing to the salary being either too high or too low. To write an application is a matter that involves considerable time and some little expense, and consequently we do not wish to undertake it unless there is at least a chance of obtaining a suitable appointment.

It would be interesting to have the opinions of some of your other readers on this question. In the meantime, may I appeal to those who may have situations vacant in the future to state definitely what the job is worth, in order that we may know whether it is worth our while to apply for it or not?

Applicant.

February 4th, 1919.

A Protective Association for Non-Technical Clerks.

It is pleasing to see so many interested in the question of the protection of non-technical staffs in connection with the electric supply undertakings.

Whilst we are all agreed, I think, that some association is essential for the protection of our interest, there appears to be a difference of opinion as to the best methods of attaining this object.

"Power Company Clerk" suggests that we join the N.U.C. under the guild system, but I think that it would be more in our interests to form a new union which, if the proper support was forthcoming, could approach the E.P.E.A. with a view to affiliation, and the two sections would then cover the whole of the staff of the industry.

It would be interesting to hear more as to the general standing of the Clerical Assistants' Association (Electric Supply Undertakings) mentioned by your correspondent.

Could not those interested meet in the near future at convenient centres, say, London, Birmingham, Manchester, Leeds, Newcastle, Glasgow, in order to get a move on?

Supporter.

February 5th, 1919.

Balanced Three-phase Furnace.

With reference to my contribution to the discussion on Prof. Miles Walker's paper, and the author's reply in the current number of the I.E.E. *Journal*, will you allow me space to explain that in a practical application of the idea I was intending to meet the difficulty of obtaining sufficient resistance by means of the form of the furnace bowl or well. It would be divided to secure a restricted path between the bottom electrodes, or even to force a secondary arc through the slag from the surface of the metal in one half of the well to the other.

Otherwise the heavy current could be put into the metal by the inductive method. I fully recognise that the practical details require careful elaboration, but there may be germs of usefulness in the suggestion.

James Whitcher.

Ruislip, *February 5th*, 1919.

Electrified Seed.

Your correspondent "Wide Awake" is too clever by half. He has the acute penetration of the sailor's mother.

"No, John," she said, "I believe you when you say you discovered mountains of sugar and rivers of rum, for where else can sugar and rum come from? But when you tell me you have seen flying-fish, you are trying to impose on your old mother. Fish don't fly. It is against their nature." So "Wide Awake" can believe in electrified chickens, for he has seen them himself, but that seeds can be electrified is too much for him.

He says that farmers are not as a rule competent to carry out scientific experiments. Perhaps they are not, and it is fortunate that in growing electrified seed they are not required to experiment; but they are as good judges as other men of whether their banking accounts show a profit or a loss, and when they find that electrification of their seed corn increases their returns by an average of about £5 per acre, they don't trouble themselves about scientific experiments. They just pocket the money and do it again.

I am not a matchmaker, but I cannot but suggest that if "Wide Awake" were to marry the sailor's widowed mother, they would be mated—and matched.

Chas. Mercier.

Parkstone, *February 10th*, 1919.

The Abortive Electrical Strike.

I attended our last branch meeting; usual business, &c. On Saturday, saw notice in the Press *re* important meeting of members of the E.T.U.; being on shift, could not attend. On Tuesday, saw notice in Press *re* strike; Wednesday, saw more about strike; Thursday, having heard nothing official

by post or otherwise, I interview shop steward, who knows nothing, except that he has attended one or two meetings, proceedings of which he will not divulge. At a meeting that was held on Friday, members were informed that they ought to have come out, notice in the Press considered sufficient. In conclusion, I think it is time that members of the E.T.U. protested against their union being used to advocate George Lansbury's political views, *re* Albert Hall lights out, and the sale of *Heralds* at meetings; if there is a strike, it is nothing more than camouflage to advocate George Lansbury's views, and not those of the members of the E.T.U., but the officials only. Otherwise, do I belong to a trade union or a political party? as I, for one, in return for better conditions, &c., do not intend to accept any political views with it, in return for those services which I pay for, otherwise, where does the motto, "Light and Liberty," come in?

Member, E.T.U.

Thursday, February 6th. Time, 12 o'clock M.D.
Scene: A large London electric light and power station.
Threat: 6 p.m. to-night, London in "darkness."
The Station Chief, wondering what's going to happen.
The Shift Engineer, thinking, Let all the E.T.U. men go, what is going to happen?—practically nothing, we shall go on as usual, with substitutes on the switchboard, that is all.
The Switchmen: What is he thinking? He knew, but said nothing, and so we waited.
Six o'clock came, nothing happened; not even a blink on the lights.
Now, what do the public think in general of these E.T.U. men in the power stations, who failed to do as Mr. Webb (who apparently did not know the position of his union in an electric light station) said they would do?
I think, under the circumstances, something should be said about these men, who knew at 9.30 on Wednesday night all would be well, because all these had voted against such an action, but we could only wait and see.
I, a member of the E.P.E.A., think these men should have the credit for voting thus, and not be blamed for the threat of someone else, a threat that could not have been carried out.
Do not let the public blame the power station branch of the E.T.U., but thank them for remaining loyal to their employer, and saving us any trouble in running the stations.

Shift Engineer.

London, *February 8th*, 1919.

You may be interested to hear of our experiences during the strike last week.
The whole of our station staff, with the exception of three or four labourers, went out at 6 p.m. on Thursday, together with many of the outside workers. The shift engineers, who are members of the E.P.E.A., of course, remained at work.
The strikers were at once replaced by an ample supply of voluntary labour. The volunteers were fed, and in many cases given makeshift sleeping accommodation at the works. No difficulty whatever was experienced in maintaining the full supply until the strike collapsed, and the men returned to work on Saturday afternoon.
We feel deeply indebted to the public spirit of the townsmen of Twickenham and neighbourhood which induced them to volunteer to help to keep the supply going. We had so many offers of help that we were only obliged to call on a proportion of those who kindly offered their services, and we were quite prepared to carry on indefinitely had the strike been prolonged.
Many soldiers on furlough offered their services, and we were also assisted by several members of the special constabulary.
It has been an interesting object lesson of the futility of the threat of the E.T.U. that they would "plunge the town into darkness."

Twickenham & Teddington Elec. Supply Co., Ltd.
M. Farrer, *Engineer & Manager.*

Twickenham, *February 10th*, 1919.

In connection with the recent threatened electricians' strike, the Press need not have whipped the public into a panic. As a body, the members of the E.T.U. are patriots to the last fibre of their being, and are not being blindly led away by a small Bolshevic element in their midst. The strike would never have materialised for such an object, and few of us indeed could have stood by our honour to the Union. Had the object been a wage dispute or similar trouble, the Government would have seen the futility of their theatrical resuscitation of the moribund pseudo-laws by which they threatened us. E.T.U. members are *Englishmen and* unionists. As Englishmen they would have the courage of their convictions, and stand out for their just claims. As unionists they would have supported trade unionism only in so far as the principles applied. If the E.T.U. officials think they are going to make a political and Government-fighting body of us, they make a grave error, and the sooner such ideas are abrogated the better for the E.T.U. and its membership. I speak as a one-time representative of a large body of E.T.U. men.

A. Bridges.

Teddington, *February 9th*, 1919.

Electrical Contracting.

I noted with pleasure the footnote and reply by the Editor to Mr. H. Fowler in your issue of January 24th, but cannot understand why it was not pointed out that you had special columns and rates for advertisements. It would have been better if Mr. Fowler had devoted his spare time to finding out the real facts about the work which he states has been condemned. If he will do this he may find that it is not the system or materials that are at fault, but the workmanship, for which the same union wages are paid by any firm. It is so easy for one to sound his own trumpet, to curry favour, and at the same time to work in an advertisement that "we are the only people."
As a Liverpool contractor I feel that Mr. Fowler's statements are unwarranted, and perhaps when he has had more experience as a boss, and carried out a few installations in that capacity, he will wish that he had written a book of instructions for his fellow-workmen, instead of trying to tell us contractors in an advertisement what we all agree upon.
In Liverpool we have Corporation and insurance inspectors of high knowledge and experience, who may give Mr. Fowler many an anxious moment in the near future.

Amused.

Liverpool, *February 7th*, 1919.

I am afraid Mr. Marryat is discussing something entirely different to the subject which I dwelt upon under the above heading some few weeks ago in the Electrical Review. I cannot find anything relating to members of the Electrical Contractors' Association, as being responsible, or any suggestion that they have been responsible, for putting in unsound electrical installations, in any part of my letter. In fact I was not aware that I mentioned the Electrical Contractors' Association at all. I shall be pleased if Mr. Marryat will produce the evidence in my letter, which he describes as an assertion against the Electrical Contractors' Association.
I may, for Mr. Marryat's future guidance, point out to him that I have the list of members before me at the moment of writing. I regret to find that some large electrical and contracting local firms, which I know of, are not mentioned in that alphabetical list.
The object of my letter was to uplift the electrical installation profession; it is immaterial to me who undertakes the work, so long as it is carried out in a proper manner. Whether the contractors be in a big way or only in a small way, it is to be hoped that they will always try to put in a good job, not always with the object of grabbing all they can get out of it, regardless of how long the installation will stand good.

H. Fowler.

Liverpool, *February 7th*, 1919.

On reading through the correspondence column of the Electrical Review of January 24th last, I came across a letter under the heading of "Electrical Contracting," signed by Mr. H. Fowler, and, in my opinion, as a bare-faced and cheap advertisement, both for himself and the house-furnishing firm which he says he represents, it would be hard to beat. After setting forth his various desires that this thing and that thing might be done, and also making statements on electrical matters with which we are all conversant in this district, and that he is more than pleased that the matters which he has so weakly taken up are (after your informing him of the fact, Mr. Editor) in the right hands, he accuses firms, firms only known to himself, perhaps imaginary, of doing shoddy work. He also tells us that he is now a representative of a large contracting firm (presumably he is referring to Messrs. Waring & Gillows, who, as everyone knows, are far more interested in the house-furnishing line than in the electrical engineering business), and seeing that he is in such an exalted position, and refrains from expressing any opinion on the matter he has so poorly taken up, excepting to make accusations against other firms, apparently his mock modesty far exceeds his knowledge of electrical matters generally.
In conclusion, the matter he has tried to write about from beginning to end is, as before stated, a cheap form of advertisement, and you would have been quite justified, Mr. Editor, in sending Mr. Fowler (representative of large firm of electrical contractors) your account before inserting it.

Live and Let Live.

February 8th, 1919.

Engineer Surveyors' Salaries.

The inspecting staffs of insurance companies and also "would-be" inspectors should be grateful to Mr. A. J. Abraham for his letter to you which appeared in your issue of January 17th. It may be of interest to your readers to know that after 21 years' service some inspectors are rewarded with a salary of £230, whilst in pre-war days the figure

was £198. These 21 years' men had also to be very careful "how they walked," or they were discharged, and new men put in their places at a lower salary. It may also be of interest to quote a few dividends paid to the shareholders of these "leading insurance companies" doing engineering business: Royal, 100 per cent.; Norwich Union, 70 per cent.; London and Lanc. (Law Accident), 66 per cent.; Commercial Union (Ocean & Union Assurance), 140 per cent.; Yorkshire (Scottish), 50 per cent.; Vulcan, 25 per cent.; British, 25 per cent.; National, 35½ per cent. These figures were circulated by the Engineer Surveyors' Association a few months ago. Oh, yes! there is an association to watch over the interests of its members, and the scale of salaries offered may be taken as a criterion of its usefulness! About 75 per cent. of the inspectors employed by the insurance companies are members, and the majority are in favour of the association being registered as a trade union. The stumbling blocks in the way of this becoming a concrete fact appear to be the Manchester and London branches, and as the head offices of the majority of the companies are in these cities, the inference appears to be pretty obvious.

The reasons advanced against registration as a trade union appear to be that to be a trade unionist is to lose in self respect more than one gains in £ s. d.; or, in other words, to be shabby genteel, and a non-unionist is "a far, far better thing" than to be a trade unionist and own a row of houses.

In short, the reason why leading insurance companies can offer such small salaries is that the inspectors are not organised as a body—their employers are.

Pitman.

Early Wireless Telegraphy.

With reference to the letter of Mr. A. A. Campbell Swinton which appears in your issue of January 31st, I quite agree with his statement that there is no foundation for the suggestion that when I first came to this country I failed to meet with sympathy in official circles, at any rate so far as the late Sir William Preece, Sir John Gavey, and Mr. H. R. Kempe, of the General Post Office, are concerned. It is quite incorrect, however, to say that the assistance of this department "included the use of a considerable sum of public money." This is an allegation which I have repeatedly denied, notably in evidence which I gave in 1907 before the Select Committee of the House of Commons on the Berlin Radiotelegraphic Convention of 1906, and again in 1913 before a Select Committee of the House of Commons appointed to inquire into the agreement of 1912 with the Marconi Co.

In the interests of ordinary—as well as historical—accuracy I cannot do better than reproduce here two extracts from the aforesaid evidence. In 1907 I said:—

"If you will allow me, with reference to a general idea that there is in existence about my early relations with the General Post Office, I wish to state that I shall always feel grateful for the encouragement they gave me, and the interest they took in my methods during those early trials. At the same time, I would also like to state, on account of a belief that there is about it, that I obtained no financial assistance from the Post Office; fortunately I did not require it at that time; I only thought it necessary and thought it desirable to interest them in what I was doing, and to show them what I could do."

And in 1913 my words were as follows:—

"I think it right to repeat what I stated before the Select Committee on the ratification of the Radiotelegraphic Convention of Berlin, that I feel grateful to the Post Office authorities for the encouragement they gave me, and the interest they took in my work during those early trials. I wish, however, most emphatically to state that at no time have I ever received from the Post Office or any Government department anything in the nature of a favour which would not have been in common courtesy afforded to any scientific worker by any Government in any other country of the world."

Neither Mr. (now Sir) John Gavey, who gave evidence before the 1907 Committee, nor Mr. (now Lord) Buxton, who was then Postmaster-General, and who was a member of the committee, said anything that could be construed as a refutal of the evidence I have reproduced above.

What I greatly regret, however, and, if I may be allowed to say so, this constituted to my mind a mistake on the part of the Post Office, is that I was practically compelled to allow my experiments in South Wales in May, 1897, to be witnessed in all their details by Prof. A. Slaby, of the Charlottenburg Technical Institute, and a personal friend of the Kaiser. Previous to these tests I did not know Prof. Slaby, nor had I expressed the slightest desire to allow him to witness my experiments, but did so out of courtesy to the British Post Office officials, who introduced him, and who made the request.

G. Marconi.

London, *February 5th*, 1919.

The Shorter Working Week.

May I be allowed to give a few facts concerning the shorter working week? Several months ago we learned that the Government were lessening the period for delivery of war material, and the chances of the war ending were discussed. Out of these discussions arose the question of after-war unemployment. Some of the members were in favour of demanding a 48-hour week, others a 44-hour week; while one of the north country representatives advocated 40 hours per week, *i.e.*, 8 hours per day for 5 days and off all day Saturday, or if in all day Saturday, then off all day Monday. This shortened working week was favoured as the best means for steadying employment. The trade unions were faced with a tremendous problem. Assuming that 8 millions of workers had to be displaced from the munitions factories or demobilised from the Army and Navy and reabsorbed into private industry, there appeared to be but one way to secure this reabsorption without the wholesale sacking of those who had been engaged on private work through the war, and that was by way of the shorter working week and the abolition of overtime. The women did not present so much of a problem as the men. The women, it was taken for granted, would want to get away home as soon as their husbands secured their release. If we take into consideration at this juncture the number of women who can be reasonably replaced by returning men, and the redistribution of jobs so that two men are made to work, say, 40 or 47 hours per week instead of one man working 80 hours, the difficulties can be got over in a fairly smooth manner, with the chances of unemployment for even a small residue reduced to nil. The problem of the shorter working week is also one for the sociologist as well as the economist. To-day commodity prices are so high that wives of returned soldiers may have to continue at some form of work to make both ends meet. But we know for a fact that soldiers are expressing resentment and disgust at being robbed of the chances of the full benefit of home life on their return, by reason of their wives having to go out, and thereby neglecting the usual home duties, or as a compromise by both remaining at home in the evening to do the cooking and cleaning.

The movement for a shorter working week and more money is bound to become a national one, and the power stations will, of necessity, become involved in it.

John Vincent,
Secretary,
National Amalgamated Union of Enginemen, Firemen, &c.,
Marylebone Branch.

London, N.W., *February 10th*, 1919.

[Several letters are unavoidably held over.—Eds. Elec. Rev.]

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

The following further contributions have been received in response to the appeal made by Mr. Hunter, the chairman of this Institution:—

	£	s.	d.		£	s.	d.
McKenzie & Moncur, Ltd.	2	2	0	J. W. Darling		10	6
Fernand Espir	1	1	0	F. J. Rayment	5	5	0
Batterseа Electric Works (Staff)		15	0	H. J. Riddell		10	6
H. A. Sharples	1	1	0	Electric Installation, Ltd.	2	2	0
W. Young		10	6	C. T. Walrond	1	1	0
Newcastle-on-Tyne Electric Supply Co., Ltd.	50	0	0	Mersey Power Co., Ltd.	10	0	0
George Ellison	5	5	0	A. Davy		10	6
H. J. Cash & Co.	2	2	0	Cryselco, Ltd.	10	10	0
Chas. Silcock	1	1	0	A. F. Roffey	1	1	0
				H. L. Leach	1	1	0

LEGAL.

British Accumulator Co.'s Liquidation and German Patent.

In the Chancery Division, on February 5th, Mr. Justice Astbury had before him a summons taken out by Mr. Geo. Walker, liquidator of Walton & Clough, Ltd., creditors of the British Accumulator Co., Ltd.

Mr. Cunliffe, K.C., appearing for the liquidator, said that the Accumulator Co. was formed to work a certain patent; the vendor was a German named Vilne, and apparetly no one could manufacture these things but German workpeople, and that was the explanation why the company came to grief. They entered into an agreement with Walton & Clough, of Bradford, under which the latter set aside part of their works in order that the British Accumulator Co. should set up plant for the manufacture of accumulators. It was in respect of the expenditure in connection with the setting aside of these works, erecting the necessary buildings, and setting up the plant that the liquidator of Walton and Clough made a claim in the liquidation of the British Accumulator Co. The claim was for £1,500.

MR. F. RUSSELL, K.C., for the liquidator of the British Accumulator Co., said they regarded the claim as wholly unjustifiable.

MR. ASHTON CROSS, for the claimants, read evidence to the effect that the company's production of accumulators was satisfactory, but the work could not be finished, because the Accumulator Co. did not obtain lamp cases from Germany.

His LORDSHIP, in giving his decision, said the whole matter depended upon the construction of the agreement, and under that document he held that the applicants could only claim under Clause 21, and that applicants had put themselves out of court in respect of any such claim. The summons must be dismissed without prejudice to any claim other than that included in the present claim which the applicants might rightly make against the company in respect of accumulators. The applicants must pay the costs.

ELECTRICAL WORKER'S INADEQUATE COMPENSATION.

IN the Shoreditch County Court, on February 6th, before his Honour Judge Cluer, there was an application under the Workmen's Compensation Act in the case of Charlotte Kennedy, of 37, Goswell Street, Hackney Road, an electrical worker, against the Little Wonder Battery Co., Ltd., of Willow Street, Great Eastern Street. On November 11th, 1918, the ceiling fell on the girl's head, causing rather bad contusions, and she was still suffering. She had been receiving compensation at the rate of 25s. a week, and it was now sought to settle the matter for a lump sum of £10; but the Registrar had refused to agree to it, as it was much too small a sum. The matter, therefore, had come before the Judge. The girl now said she suffered very badly with headaches, but for the respondents it was suggested that there were the usual cures for such things, and perhaps it was questionable if they were there.

JUDGE CLUER said the sum offered was totally inadequate, and he would refuse to agree to a settlement.

FORTY BOSCH ELECTRICAL PATENTS.

BEFORE the Controller of Patents, in the Patents Court, London, on Friday, February 7th, an application was made by the British Lighting and Ignition Co., Ltd., of Tottenham Court Road, London, W., for licences to use a batch of 40 of the patents of Robert Bosch, of Stuttgart. There was no opposition to the application.

For the applicants, MR. MELLERSH-JACKSON said that the firm had previously been granted licences in respect of several of these enemy patents. The patents now applied for comprised sparking plugs, ignition apparatus for the electric lighting of motor vehicles, and also starting appliances for motors, and were over various dates in the years 1905 to 1915. Those having relation to electric ignition and lighting appliances were closely connected with one another. All were intended to be used in motor vehicles.

MR. TEMPLE FRANKS, the Controller of Patents, asked whether the firm was taking up all these patents.

The ADVOCATE replied that they proposed to manufacture on a very large scale, and would probably use them all.

MR. TEMPLE FRANKS intimated that the granting of licences would be recommended on the same terms as in the previous cases.

HARRIS *v.* GRANT HUGHES.

THIS action, which was a claim for an account of the sale by the defendant of a quantity of asbestos, came before Mr. Muir Mackenzie, in the Official Referee's Court, on February 10th, when the parties came to a settlement in the early stages of the proceedings.

Mr. A. Powell, K.C., with Mr. Lincoln Read, appeared for the plaintiff, and Mr. Compston, K.C., with Mr. Neilson, for the defendant.

MR. POWELL said that the action was brought for an account respecting dealings with asbestos, a quantity of which was over here and in the hands of the defendant for sale, and he frequently said that he had sold it to Callender's Cable Co. at £40 a ton. The plaintiff asked for an account, but did not get any. Having got some information, he thought it better to write to the defendant respecting the business. He did so on several occasions, but could get no answer, in consequence of which he placed the matter in the hands of his solicitors, who issued the writ in June last, after having written to the defendant without result. Since the action the defendant had delivered no fewer than four different accounts.

At this point of counsel's opening, MR. COMPSTON asked for a brief cessation of the proceedings, in order that he might consult with plaintiff's advisers with a view to an arrangement.

After a short interval, MR. COMPSTON said he was glad to be able to announce that the Court would not be further troubled with the case. There were certain difficulties in the way, and his client had placed himself unreservedly in the hands of his counsel, with the result that there would be judgment by consent for £300, with costs, £250 to be paid down, and the remaining £50 in a month, the defendant giving his acceptance for that amount. The costs were to be paid after taxation.

Judgment was entered in accordance with these terms, the Referee observing that execution would only issue in the event of the terms not being carried out.

MR. COMPSTON said that the asbestos remained in defendant's hands, and the judgment was on the holding that it had all been sold. The £300 represented the plaintiff's share of the profits.

BUSINESS NOTES.

The Government and the Railways.—The directors of the Lancashire and Yorkshire Railway begin their report with the following:—

"The proprietors will have noticed in the Press announcements as to the future control of railways. Those responsible for the management of the railways have endeavoured, in the interests of the shareholders, to obtain some definite information from the Government as to their intentions in the matter, but, so far, without success. All that we know to date is that, during the recent election, a member of the Government intimated that it was the intention of the Government to acquire the railways; and whilst since then we have endeavoured to ascertain exactly what are the views of the Government, the only information we have is the public announcement made in the Press that the Prime Minister, in an interview with a deputation from the National Union of Railwaymen is reported to have said that the Government contemplate the establishment of a Ministry of Ways and Communications to deal with the whole of the railways and the electrical industry, both for transport and power purposes, and that a Bill conferring the necessary powers upon the Government will be the earliest measure introduced into the new Parliament, and will be speedily passed into law. It has not been possible to elicit any information from the Government as to the method of future control, nor as to the terms under which such control will be initiated or exercised.

Non-Ferrous Materials.—Stocks (exclusive of old metal and scrap) in this country in the possession of the Minister of Munitions on February 1st, 1919:—

Copper	41,882 tons	Soft pig lead ...	86,493 tons
Spelter, G.O.B ...	23,905 „	Nickel	2,388 „
Spelter, refined ...	7,734 „	Antimony regulus	3,731 „
Aluminium ...	13,092 „		

British Orders for British Firms.—The Executive Committee of the British Empire Union has addressed a circular letter to public authorities, suggesting that, as peace is approaching, it would be extremely desirable if they would issue a public announcement that no tenders will be received from, and no contracts given to, any firms connected, directly or indirectly, with the enemy Powers, and that preference will always be given, as far as possible, to genuinely British firms employing British labour. Such an announcement, it is added, would go far to ensure that taxes, which must necessarily be heavy, would be expended for the benefit of British trade and industry instead of for the advantage of enemies, whose atrocities have placed them outside the pale of civilisation.

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. LVII, No. 278. January, 1919. London: E. & F. N. Spon, Ltd. Price 7s.—This issue contains a paper by Mr. J. H. Shaw on "The Use of High-Pressure and High-Temperature Steam in Large Power Stations," and one by Prof. Miles Walker on "The Supply of Single-phase Power from Three-phase Systems."

"The British Dominions Year Book, 1919." Edited by E. Salmon and J. Worsfold. London: The Eagle, Star and British Dominions Insurance Co., Ltd. Price 1s.

"*Bulletin* of the Société Belge des Electriciens." Vol. XXXI, August-December, 1914. Vol. XXXII, 1915-16-17-18. Brussels: Emile Bruylant. Price 1 fr. 75 each.—It is with great pleasure that we welcome the return of the *Bulletin*, and read on page 1 of the four-year issue the note of triumph and rejoicing (not without a tinge of sadness) with which the publication is resumed. We echo the exultant "Vive la Belgique" with gladness that Belgium still is.

"Electrolysis and its Mitigation." By E. B. Ross and B. McCollum. Washington: Government Printing Office. Price 35 cents.

Ways and Means, the new sixpenny weekly review which Mr. Ernest Benn is shortly bringing out, is not intended to be a trade paper in the ordinary acceptance of that term. Its object will be to keep the public better informed than it has been in the past in regard to general industrial matters, and the principles of industrial administration, industrial reconstruction, and self-government for industry. It will endeavour to be to trade what the *Spectator* and the *Nation* are to politics, and will contain the views of manufacturers, Trade Union officials, and others seriously interested in industrial questions who may be willing to record their experiences or to express their opinions. The publishing office of *Ways and Means* is at 8, Bouverie Street, E.C. 4.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVIII, No. 1. January, 1919. New York: The Institute. Price $1.

Trading with the Enemy.—The *London Gazette* of February 7th contains a further list of names of bodies and persons abroad with whom trading is prohibited, or whose names have been removed from the list.

Batti-Wallah Talk on Foreign Competition.—At the next luncheon of the Batti-Wallahs, which is to take place at the Holborn Restaurant on Monday next, at 1 o'clock, Mr. J. H. C. Brooking, general manager of the St. Helens Cable and Rubber Co., Ltd., is to give a short talk on "How Shall we Meet Foreign Competition?"

Tyneside and New Industries.—At a meeting of the Newcastle-on-Tyne Chamber of Commerce on 6th inst., Mr. D. Stephens presiding, a report of a special committee appointed to consider new industries for the Tyneside was considered. It was pointed out that as foreign competition with the two staple local trades—shipbuilding and engineering—became more keen, it would become increasingly important to have new industries established. Industries dependent upon electrical energy which might be established in the neighbourhood were electrochemical work generally, and the manufacture of carbide of calcium, sodium, potassium, phosphorus, silicon, magnesia, &c. It was thought that the following commodities might be provided in the district:—

Steel boiler-plates, steel castings, forgings, furnaces for cylindrical boilers, tubes, steel, iron, brass and copper rivets, stampings, general equipment, such as marine engineers' stores, engine fittings, such as pressure and vacuum gauges, air gauges, mechanical indicators, telegraphs, lubricators, radiators, flour, cocoa, tin-ware for packing tobacco, dry-salters' and ships' stores, biscuits and other goods, paper-making industry, locks of all sorts, boot laces, buttons, cheap clocks and watches, soap, starch, steel files, cutlery, special tool steel, chain-making, flexible wire, yellow metal plates, motor cars, aircraft, scrap tin, the recovery of zinc from galvanised scrap steel and iron, the making of coal briquettes, and agricultural machinery and other articles.

The committee desired the possibilities of development in the neighbourhood to be as widely known as possible. The report was adopted.

Sir Robert Hadfield's Views on the Industrial Situation.—Sir Robert Hadfield has written an article for the *Pall Mall Gazette* in which he looks at some of the causes of "Labour Unrest." First, he says, many employers failed in the past to advance with the times, which is unquestionably true; indeed, the failure is not entirely a thing of the past. Secondly, he says that the workers are tired out after the long strain of war; that, too, is equally true—true of us all, whether we be privileged to count ourselves as "workers" or no. Sir Robert refers to his own company's 23 years' experience of the working of the eight-hours' day, and he says that if other firms had adopted that change when they were criticising Hadfield's for so doing the country would not now have been faced with almost universal unrest in the ranks of the workers. Employers proved too tenacious of old methods—they moved too slowly—with the result that workers to-day were determined to force the pace, and were making all sorts of vigorous demands. If changes had been effected gradually, the country would by now have been ready to discuss a 44-hour week. We were so chary of making experiments, so fearful of new ways. We could learn from the lessons of the past not to be so timorous in our dealings with Labour. "The experience of firms which had tried the 48-hour week shows conclusively that it does not mean the end of all things." Sir Robert agrees that many times trivial grievances have been allowed to develop into unrest. He cites a case where the workmen represented that it would be a great boon if they were allowed to have a smoke after breakfast. Given that the character of the work does not make it dangerous, why not allow it? "You and I like a cigarette after breakfast, and should probably grumble if it were forbidden us!" This may be regarded as a typical case where the human element may be introduced without sacrifice of anything material. As to the demand for larger production per worker, Sir Robert says that when all are over-tired by reason of war strain it must be recognised that there is a limit to each man's capacity for output, and no one can desire to keep up the war rate.

"The present demand for shorter hours is, in a considerable measure, a reaction against the terrible pressure which was maintained during the war. But if shorter hours are to be introduced, what becomes of the predominant demand for greater production? There will be an output above the pre-war level, but it must be achieved by machinery, and not by human sweat. We must use the mechanical element, and the improvements and developments which are always being accomplished. This, to my mind, is the true line of progress, and is in the best interests of all concerned. Speeding up workers in order to obtain greater production will, if pushed to extremes, defeat its own object, because it will lead to endless friction. The chief point is to speed up the mechanical element rather than the human one." Sir Robert finally desires that international industrial conditions should be equalised as much as possible. "If the many nationalities now represented at Paris could agree on a basis for the hours of labour, production, and other important questions, many problems would be solved. It should not be beyond the wit of the leading statesmen of the world to draw up a basis for the eradication of excessive, and therefore unhealthy, competition, while still leaving the field open for fair and friendly rivalry."

Siemens's and South Africa.—In the course of an article appearing in the *South African Mining Journal* for January 4th an account appears of the objects of a special mission that was recently sent to South Africa by Messrs. Siemens Bros. & Co., Ltd., of London. The mission was composed of Messrs. W. B. Hopkins and F. H. Leonard, and its work is threefold: to make clear the change in the nationality of the firm; to notify the enlargement of the scope of the company's business; and to make known the conclusion by the company of industrial alliances in various directions. Incidentally, the mission is studying in South Africa and elsewhere the possibilities of electrical engineering, as well as the scope of the market for electrical plant and material of all kinds. The article continues:—

"As far as export business is concerned, the selling end of the business will be handled by representatives appointed by the associated firms, and the mission now here is charged with reporting on the most feasible method of establishing these in accord with local conditions. By this means duplication of representatives is avoided—a form of wasted effort very common in the past. Siemens Bros. & Co., Ltd., erected the first telegraph lines in Cape Colony 55 years ago, and have constantly supplied such material to the South African Governments since that time. They hope that now that the German influence has been eliminated they will be able greatly to extend this field of electrical enterprise throughout the whole of South Africa. Mr. Hopkins and Mr. Leonard have expressed their conviction that this working alliance of such powerful electrical industries under the protection and consent of the British Government will enable them to secure a large share of the many installations of electrical plant that will undoubtedly be wanted in the near future. Both also expressed themselves as greatly pleased with the co-operation they had been accorded by the British Trade Commissioner for South Africa, Mr. J. L. Wilson Goode. They expressed the opinion that if British Government officers continue to co-operate as heartily with all British industrial representatives as they have with them, it will be a long step towards beating the Germans who, before the war, were already well established in South Africa. Both gentlemen also voiced their warm appreciation of the kindness and sympathy with which they had been everywhere met throughout South Africa. They leave shortly for India and the East, in continuation of their trip round the world. In their tour round South Africa, Mr. Hopkins and Mr. Leonard are accompanied by Mr. A. J. G. Simpson, representative in South Africa for Messrs. Siemens Bros. and Co., Ltd."

Fire.—A large wooden shed on the premises of Messrs. E. Brook, Ltd., electrical engineers, Empress Works, Huddersfield, used for storing cores, was completely destroyed by fire last week.

Export Restrictions Relaxed.—The *London Gazette* of February 7th contains a notice of further relaxation of export restrictions.

Trade Announcements.—MR. ARTHUR POWELL, electrician, of Church Hill, Ramsgate, has resumed business on his return from active service.

MESSRS. ASHTON & HOLT, electrical engineers, of 15, Cross Street, Ryde (I. of W.), have reopened the business, the principal of the firm and several of the staff having been demobilised.

MESSRS. WELLMAN BROS. & CO., of 42 and 43, Peascod Street, Windsor, have reopened their electrical department under the management of Mr. C. Howlett, late R.E.

MR. THOS. SPEAK, who has been released from the Army, is reopening as an electrical engineer and contractor at Library Street, Blackburn.

Mr. Henry Joseph has now opened business in Birmingham as the MIDLAND ELECTRIC POWER INSTALLATION CO., with Old Mill Street, Wolverhampton, as his address. The premises have been taken for motor repairs, and, in fact, for the repair of anything electrical in connection with factory driving. The firm undertakes lighting as well as power work in factories, both in Wolverhampton and Birmingham. A staff will be kept at both towns, but business will be conducted from Wolverhampton.

We understand that the NEWALL ENGINEERING CO., which during the latter part of the war was taken over by the Ministry of Munitions and operated as a national gauge factory, has now reverted to its former proprietors, Messrs. Peter Hooker, Ltd. Accordingly, it is understood that the company intends to reorganise and develop its well-known pre-war business in gauges, micrometers, and measuring machines, together with additional specialities which will shortly be announced. The Newall Engineering Co. has appointed Captain R. J. Bray, Director of the Machine-Tool Section, Aircraft Production Department, as general manager, and interesting developments are anticipated.

MR. ALAN E. DENT, A.M.I.E.E., of Nelson, Lancs., has recently acquired the business of Mr. Arthur Peel, electrical engineer, Russell Street, Nelson.

MESSRS. L. G. HAWKINS & CO., are to-day removing to larger premises at 116, Charing Cross Road, W.C. 2, where new departments are being opened for the supply of electrical materials. Temporary telephone number, "Gerrard 2490." The firm issues a fortnightly publication, *The Electrical and Mechanical Exchange*, for trade concerns and individuals actually engaged in the electrical or mechanical industries.

Plant for Disposal.—Gillingham Corporation electricity department has for sale one 50-KW., three-phase, 2,000/2,200-volt, 50-cycle B.T.H. alternator and exciter, direct coupled to a two-crank compound Willans engine, one main and exciter panel, one 22-H.P. compound vertical engine, and one 5-H.P. single cylinder vertical engine.

Bermondsey Borough Council invites offers for one Willans and Robinson 75-KW. steam dynamo. For further particulars see our advertising pages to-day.

Liquidations.—Radium, Ltd., 66, Basinghall Street, E.C.—First and final dividend of 20s. in the £, payable at 33, Carey Street, W.C.

British Telegraph Instrument Co., Ltd.—A meeting of members will be held at 179, Clapham Road, S.W., on March 12th, to hear an account of the winding-up from the liquidator, Mr. J. H. Webb.

Bankruptcy Proceedings.—Charles Mayfield, 19, All Saints' Road, Clifton, Bristol, electrical engineer.—The first meeting of creditors was held on February 5th at the Official Receiver's office, 26, Baldwin Street, Bristol, before Mr. W. Ormiston, Deputy Official Receiver. It appeared that the gross liabilities amounted to £1,345, all of which was expected to rank, and the assets to £4 7s. The failure was ascribed by debtor to heavy expenses in experimenting and developing inventions, inability to develop his electrical business on account of the war, and interest on loans from moneylenders. The Official Receiver remains trustee.

A. Matson, electrical engineer, Stockton-on-Tees.—Application for debtor's discharge granted on January 14th, subject to conditions. Last day for proofs for dividend, February 22nd. Trustee, Mr. H. M. Hardy, O.R., Court Chambers, Albert Road, Middlesbrough.

A. F. Hawdon, electrical engineer, Gosforth.—Debtor's discharge suspended for two years and six months from January 16th, 1919.

Presentation Dinner.—The resignation of Mr. John A. Crabtree, works manager of Messrs. J. H. Tucker & Co., Ltd., King's Road, Hay Mills, was fittingly marked by numerous presentations from the various departments of the firm. On Tuesday evening, the 28th ult., the office staff assembled in the canteen, and, after some musical items rendered by the Telac Musical Society, accompanied at the piano by Mr. H. Pratt, Mr. R. H. Lamb in a few well-chosen words recalled the time when Mr. Crabtree first went to Messrs. Tuckers, Ltd., about twelve years ago as a draughtsman. He had risen by successive stages to the position he was now relinquishing—works manager and chief designer. Mr. Lamb then asked Mr. Crabtree's acceptance of a gold Masonic medallion with a diamond centre, suitably inscribed, on behalf of the office staff. Mr. Crabtree thanked Mr. Lamb and all the members of the office staff. During Friday afternoon, Mrs. Cruickshank, on behalf of the canteen staff, presented Mr. Crabtree with a gold-mounted fountain pen and a pearl paper-knife. In the evening, the works employés held a presentation concert in the canteen, Mr. A. B. Bateman, the production manager, being in the chair, at which Mr. Bisby presented Mr. Crabtree with a writing desk.

Mr. Crabtree, in accepting the presentation, remarked that in regard to the work done during the war, letters of congratulation had been received from the Admiralty and high officials thanking them for the high standard of quality and the quantity of fuses they had turned out. He enumerated how the output of fuses had increased, and said that although the figures were not tremendous, they ranked among the highest in the whole of the country for the number of fuses turned out per person. He thanked all for the conscientious way in which they had surmounted the difficulties experienced in 1917, and offered his congratulations for the way they had been able to change over from war to peace conditions. During the presentation, solos were rendered by various members of the works employés.

On Saturday, February 1st, the works staff entertained Mr. Crabtree to dinner at the White Horse Hotel (Mr. A. B. Bateman in the chair), when Mr. Willmott asked Mr. Crabtree's acceptance of an illuminated address on behalf of the works staff, and Mr. Mills read a letter on behalf of the outside representatives, who also made a presentation of a set of gold cuff links set with diamonds and a dress set of enamel and pearl studs.

During the evening musical items were rendered by various members of the works staff. The menu arranged by the Presentation Committee was a very fine one, the cards being designed as souvenirs of the occasion.

The New "C.M.A. Label" Design.—We desire to direct our readers' attention to an announcement of the Cable-Makers' Association that appears in our advertisement pages to-day concerning the new and very distinctive design of label by which genuine C.M.A. cables can be recognised on and after March 15th, 1919. This design, which is eloquent of strength, and should soon become known as indicating "the world standard of supreme quality," has been copyrighted by Mr. L. B. Atkinson on behalf of the Association for the protection of buyers who may be—as they are almost certain to be—offered alleged "C.M.A." cables by "unscrupulous competitors" of the members of the Association. The design will appear on all labels issued by C.M.A. firms on and after the date mentioned above, and the buyer is asked to watch for the label, which should be attached to all C.M.A. coils thereafter delivered to him.

Brown-Boveri Contracts.—Among the orders that Messrs. Brown, Boveri & Co. have in hand at the present time, mostly in an advanced state of completion, are eight single-phase railway generators, having a frequency of 16⅔ cycles, for the Norwegian and Swiss State Railways (three of these being 11,500-K.V.A., 16,000-volt machines); two 25-cycle, 10,000-KW. turbo-generator sets, complete with condensing plants, for the Anzan Steel Works, South Manchuria; four 12,000-KW. turbo-generators, running at the exceptional speed (for the output) of 3,000 R.P.M., for different users; and 22 single-phase locomotives, each of 2,000-H.P. continuous rating, for the Swiss Federal Railways.

Trade with Siberia, Serbia, and Rumania.—Exporters may apply for general licences to ship to Siberia all classes of goods except goods whose export is prohibited to all foreign countries—those on the A or B lists. Applications for licences should be addressed to the War Trade Department, 4, Central Buildings, London, S.W. 1. The restrictions imposed by the Trading with the Enemy (Occupied Territory) Proclamation no longer apply to trading with Serbia and Rumania, and consequently commercial transactions with these countries may now be resumed.

A Banker on the Labour Situation.—At the end of his speech as chairman of Lloyd's Bank, Sir R. V. Vassar-Smith, Bart., said:—"With regard to labour, the recent events must have caused considerable anxiety and dismay, but, however deplorable, I am not inclined to think that they can be construed as an expression of the views of the general body of labour. I believe the unions to be patriotic, and anxious to meet the requirements of the country. From its commencement I have been connected with the National Alliance of Employers and Employed, formed to promote the common interests of Capital and Labour, and much good work has been done. Our belief has been that, by conference, differences of opinion may be adjusted, and a basis made for mutual understanding. It is only by an interchange of thoughts that we can appreciate divergent points of reasoning. On the general question of the relationship between Capital and Labour, some straight talking is necessary on both sides. It is obviously impossible for the country to go on if organised labour is to put in claims that have no possible relationship to economic conditions, and often have no relationship to the question of wealth production. On the other hand, the country will not progress if the rather blood-thirsty expressions of the narrow type of employer ultimately result in definite action. The Alliance has long desired that there should be an all-round national conference, called jointly by the National Alliance, the Federation of British Industries and the Parliamentary Committee of the Trades Union Congress, to which representative trade unionists and capitalists could be invited, and thresh the whole matter out. Often in English industrial history has the country arrived at the edge of a precipice, and, after looking over, turned back again. I have no doubt now that, if it can be shown the danger of proceeding on the present lines, common sense will come to the rescue."

Indian Fibre Resources.—Mr. R. S. Finlow, the fibre expert of the Government of Bengal, is to make an investigation of the fibre resources of India.—*Times.*

LIGHTING AND POWER NOTES.

Accrington.—Proposed Extensions.—At the T.C., last week, Alderman Higham stated that it was necessary to extend the electrical plant to meet the growing demand, and they would have to install the plant rapidly, or some other authority would to do it for them. The electrical engineer was preparing a scheme for extensions.

Ballymena.—Proposed E.L.—The U.D.C. proposes to consider the question of installing an electric lighting scheme.

Banff.—Proposed E.L.—The T.C. has appointed a Committee to consider the question of an E.L. scheme for the town.

Belfast.—Strike.—At a conference between the Strike Committee and the principal employers, on Monday, an agreement was reached on the following conditions:—That on the men resuming work on the terms in operation on January 25th, a national conference of engineering and shipbuilding trades would be called to consider the question of hours of labour within 30 days from the resumption of work; that it would be suggested to the conference that a shorter working week than 47 hours would be a better system for working on the one-break system; and that, failing a settlement by such conference, that Belfast employers would arrive at a settlement with their own employés within 21 days after the national conference. The working week in operation on January 25th was 54 hours. The Trades Unions concerned decided to hold a ballot on Thursday, and if the result was favourable, work would be resumed. The Corporation had arranged for the resumption of the public services at the earliest possible moment, and the gas supply was resumed on Monday night. In order to prepare for the general resumption of work, a number of men returned to the electricity works and the usual supply was available on Tuesday morning. A limited tramway service was commenced at noon, but the strikers protested that this was a breach of faith, and the cars were withdrawn at 3 o'clock.

Bradford.—Forty-Seven-Hour Week.—The differences between the E.L. Committee and the shift workers at the electricity works have been settled by the introduction of the 47-hour week and the payment of double-time rates for Sunday shifts.

Proposed Extensions.—The Electricity Committee has asked for permission to borrow £2,165 for mains and extensions, and £74,000 for mains, transformer chambers, and other equipment for the next two years.

Brandon (Co. Durham).—Street Lighting.—The U.D.C. has decided to obtain terms from the Electrical Power Co. for public lighting. Before the war, energy was obtained from colliery companies, and it is asserted that they now ask exorbitant prices.

Burnley.—National Electricity Supply.—At a meeting of the T.C., reference was made to the B. of T. report on the future of electric power supply. The chairman of the Electricity Committee said that Burnley was suitably situated for a super-power station, and such a station at Rosegrove could deal with the whole of the district, including Nelson, Colne, and Accrington, with small transmission loss.

Canterbury.—Wages.—The T.C. has decided to increase the war bonus of the workmen at the electricity works by 10s. 6d. per week, plus 12½ per cent., and that the technical staff shall have an advance of 20 per cent. on pre-war salaries, plus merit and grade increase between that date and March 31st last, plus a total sum of £90 a year, to be paid as from March 31st, 1918, all allowances and bonus to be merged in this arrangement.

Cheltenham.—Salaries.—In connection with the application of the members of the E.P.E.A. for an advance of £90 per annum, plus 20 per cent. on pre-war wages, the T.C. has offered 10 per cent. advance, plus £30. This has been accepted by the men concerned, pending the decision of the arbitration arranged between the E.P.E.A. and the Standing Conference of E.S. authorities.

Chesterfield.—Extension.—The T.C. has agreed to supply a minimum of 60,000 units per annum, at 0·75d. per unit, plus a coal clause, to the iron foundry of Messrs. R. Hyde & Sons, at Woodseats.

Continental.—France.—The *Journal Officiel* announces the appointment of a Committee to prepare and co-ordinate schemes and investigations which have been undertaken by technical institutions and private individuals with the object of promoting the utilisation of the hydro-electric resources of the country.

Dewsbury.—Extensions Scheme Rejected.—The proposal of the Electricity and Tramways Committee to expend the sum of £83,000 on the extension of the electricity works was rejected at the meeting of the T.C. last week. Sir Mark Oldroyd's observations with reference to the Government's electricity supply proposals preceded the decision.

Dublin.—Lighting Restrictions.—In view of the fact that it has 200 tons of coal in stock more than at this time last year, the Electricity Committee has asked the Coal Controller to remove the lighting restrictions. The restrictions have resulted in a reduction in consumption of 18 per cent.

Dundee.—Breakdown.—A breakdown, last Friday, of one of the alternators at the electricity works resulted in the stoppage of the tramway service for an hour, and mills and factories dependent on electric lighting and power were cut off for several hours.

East Grinstead.—Proposed E.L.—The E.L. Committee has recommended the U.D.C. to proceed with the installation of an electricity supply scheme as soon as B. of T. permission can be obtained; Mr. J. B. Morgan has been appointed consulting engineer to the scheme, at a fee of 5 per cent. on capital expenditure up to £10,000, and 2½ per cent. above that amount.

Edinburgh.—Salaries.—The E.L. Committee has agreed to participate in the arbitration proposed by the Ministry of Labour on the demand by the technical staffs of electric lighting undertakings for an increase of salary.

Hetton (Co. Durham).—Street Lighting.—The U.D.C. is to consider the question of the street lighting of the district at its meeting next May.

Hereford.—Proposed Extensions.—The T.C. has decided to apply for sanction to a loan of £13,000 for the extension of the electricity undertaking, in order to supply the area within a 15-mile radius. The T.C. has also asked that £9,770 per annum be granted to cover the charges on capital advanced to the Council by the Ministry of Munitions for the extension of the electricity undertaking.

Huddersfield.—Inadequate Supply.—The mayor and several members of the Corporation have interviewed Sir Charles Sykes, M.P. for the borough, with respect to the inadequacy of the supply of electricity in the town, and an interview with the B. of T. upon the matter is to be arranged.

Leeds.—Proposed Extensions.—The Finance Committee has recommended the T.C. to apply for sanction to a loan of £50,000 for expenditure on electricity mains, and £25,000 for sub-stations. The Electricity Committee has recommended the installation of two 6,000-kw. turbo-alternators, at a cost of £41,130, and extensions at the Whitehall Road Works, at a cost of £135,550. The Tramway Committee proposes to install a new booster, at a cost of £2,600, and a rotary converter, to cost £3,000.

Manchester.—Price Increase.—The Trafford Power and Light Supply Co. has increased its charges for lighting to 40 per cent. over pre-war charges, and for power to 40 per cent.

London.—House of Commons Lighting.—It is stated in the daily Press that, owing to the recent threats to cut off London's electricity supply, it is proposed to provide the House with its own E.L. plant.

Hackney.—Yesterday the B.C. was to consider a report by the Electricity Committee on an application from the Leyton U.D.C. for a bulk supply of electricity, to commence next autumn. The supply is to be at 6,000 volts, 3-phase, 50 cycles, and the charge recommended is £1 per quarter per kw. supplied, plus four-tenths of a penny per unit, with a coal clause making a variation of ·01d. per unit for every variation of 6d. in the price of coal from 20s. per ton; the minimum account is to be £5,000 per annum.

Hackney.—Salaries.—On the recommendation of the I.M.E.A. and the Standing Conference of Electricity Supply Associations, the Electricity Committee has recommended the B.C. to grant the demand of the members of the E.P.E.A. for an advance of £90 per annum, plus 20 per cent., on pre-war wages.

Stepney.—Salaries.—The application of the E.P.E.A. for increased wages for its members has been referred by the Electricity Committee to arbitration.

Morley.—Price Increase.—The T.C. has increased the charges for electricity for lighting purposes from 7d. to 8d. per unit; for power the charges are to be increased from the present rate of 33⅓ per cent. over pre-war charges to 66⅔ per cent., and for motors of less than one horse-power 2½d. per unit is to be charged.

Portumna (Co. Galway).—Proposed E.L.—The Town Improvement Committee is considering the question of introducing a public electric lighting scheme.

South Shields.—Electric Cooking.—The Corporation Kitchen Committee has decided to install electrical cooking apparatus at the communal kitchen.

Street Lighting.—The electrical engineer has recommended the T.C. to use "half-watt" lamps in place of arc lamps for street-lighting purposes.

Stoke-on-Trent.—Proposed Linking-up.—After considering a recommendation of the E.S. Committee that Mr. J. H. Rider be appointed consulting engineer in connection with a scheme for a joint electricity undertaking for the areas of the Wolverhampton, Walsall, West Bromwich, Wednesbury, and Stoke Corporations, the Midland Electric Power Corporation, and the County of Salop, the T.C. referred the matter back for further consideration.

South Wales.—Strike.—The strike of electrical workers in South Wales, which started at the works of Messrs. Troupe, Curtis & Co. over conditions of labour, resulted in the whole of the members of the E.T.U. in the district coming out on Wednesday, last week. The men formulated a demand for a 44-hour week, a basic wage of 2s. per hour for wiremen, fitters, armature winders, &c., and 1s. 9d. per hour for all other grades, overtime and holiday work to be paid for at double rates, and treble rates for work between Saturday midnight and Monday morning. Owing to the fact that the stoppage of the South Wales E.P. Co.'s supply would result in the flooding of several mines, certain men in the company's employ were allowed to remain at work. The electricians at the collieries and steelworks were also allowed to remain at work. There was practically no interruption of the electricity supply, most of the strikers being wiremen, fitters, &c.

Tasmania.—Hydro-electric Department's Report.—In his report for the year 1917-18, Mr. J. H. Butters, the chief engineer, states that during the year the extension of the mains to Electrona, the erection of an outdoor sub-station, the construction of a 5-ft. diameter wood pipeline, the widening of the canal in order to increase its capacity from 10,000 h.p. to 20,000 h.p., and other work were completed, and the construction of other pipelines and extensions is proceeding. The power station has also been altered to accommodate an 8,000-h.p. set now on order. Anxiety was felt as to how the large carbide furnace of the Hydro-Electric Co., which consumes over 3,000 h.p., would affect the plant, which was already overloaded, but owing to the use of special starting devices, no appreciable disturbance took place. The undertaking has been greatly hampered by the delay in the delivery of the plant on order, and the existing plant was altered to allow of additional power being obtained as an overload. It was impossible to supply the 4,000 h.p. required by the Electrolytic Zinc Co. in January; 2,500 h.p. was supplied then, and the full amount three months afterwards. The company expects to be undertaking important new developments in the near future. The Hydro-Electric and Metallurgical Co. has given notice that it requires a further 6,500 h.p., and will need still more as soon as extensions are possible. Work is in progress on several big water-power schemes, and others are under consideration. Designs are approaching completion for the extension of the Great Lake scheme to a capacity of 42,000 h.p., and for the development of the Arthur's Lakes and the King River. A concern called the G.M.C. Syndicate has been established at Launceston for the manufacture of white lead, and expects to be in a position to use 10,000 h.p. in the near future. The sum of £127,150 is estimated to be required by the department for essential work during the present year. Owing to the fact that definite answers to inquiries cannot be given immediately, especially if Parliament is not in session, unfavourable replies have had to be given to many inquiries for large amounts of power, and Mr. Butters recommends that special legislation be passed to deal with such cases. During the year the units sold in bulk totalled 14,256,000, against 3,658,240 in the previous year, and the connections increased from 7,635 kw. to 24,205 kw.

United States.—Strike.—It is reported that large numbers of sympathisers are striking in support of the shipyard workers at Seattle. Many industries are paralysed, and tramways have stopped running. Electricity works are being operated under police protection, and wireless apparatus has been installed in case the telegraph wires are cut. Armed troops are preserving order, while the Mayor of the city has given notice that unless conditions improve at once he will take steps to operate all essential industries, and place the city under Federal control.

A later message states that the strike is coming to an end. The tramways were again working normally on Monday, and sympathetic strikes were called off.

Warrington.—Year's Working.—In his report for the year ended March 31st, 1918, Mr. F. V. L. Mathias, the borough electrical engineer, states that the new 3,000-kw. turbo-alternator is expected to be running shortly, and a new boiler is to be installed during the present year. The turnover of the sales department amounted to £7,077, an increase of £1,523 over the preceding year. The gross revenue was £50,334, against £41,204, and the working expenses were £35,904, against £28,577. Interest on loans absorbed £4,220, against £3,473; sinking fund, £5,704, against £5,158; and £5,025, against £4,171, was carried to the appropriation account. The capital expenditure amounted to £146,710, of which £8,376 was incurred during the year under review. Units generated totalled 8,695,682, of which 6,908,531 were sold, including power, 5,824,218; lighting, 461,662; public lighting, 52,142; and traction, 570,509; 1,311,997 were used on the works, and 475,154 were unaccounted for. The maximum demand increased from 3,125 kw. to 3,882 kw. The works cost per unit increased from '702d. to '807d., and the total cost from '889d. to '972d. The average price obtained was 1'46d. per unit.

Worcester.—Salaries.—At a meeting of the T.C., last week, it was stated that, in connection with the application of the members of the Electrical Power Engineers' Association for an increase of £90 per annum, plus 20 per cent. on pre-war wages, an intimation was received by the Council on February 1st that unless all the supply undertakings agreed to the demand within seven days, the members of the E.P.E.A. at all undertakings not complying with the demand would be withdrawn; and further, that unless within 14 days all undertakings throughout the country complied, members would be withdrawn from all undertakings in sympathy. The chairman of the Electricity Committee said that a further communication had been received from the I.M.E.A. stating that, as a result of negotiations with representatives of the engineers, it had been decided to grant a further few days' grace, subject to further provisions. The chairman was given authority to negotiate with the engineers.

Worthing.—Proposed Loan.—The town clerk has been instructed to apply to the L.G.B. for sanction to borrow £16,392 for electricity extensions.

Yorkshire.—Proposed Extensions.—The Yorkshire Electric Power Co. has come to an agreement with the Mexborough U.D.C. for the formation of a Joint Electricity Board for the provision of further generating plant for the southern portion of the company's area. The U.D.C.'s of Elland and Spenborough are also to be supplied.

TRAMWAY AND RAILWAY NOTES.

Ashover.—Light Railway.—The Light Railway Commissioners have sanctioned a scheme for the construction of a light railway from Stretton to Ashover, for the Clay Cross Co. The estimated cost is £68,700.

Birmingham.—Extensions.—The Tramways Committee has received authority to promote a Bill for the extension of the tramways from Selly Oak to Longbridge, and from Gravelly Hill to Erdington.

Bolton.—Track Renewals.—The Tramways Committee has authorised the relaying of the track on the Daubhill route, and the purchase of the requisite rails, points and crossings for the work.

Bradford.—New Tramcars.—The Tramways Committee has been empowered to place an order forthwith for the supply of 26 tramcars and 52 sets of motors.

Railless Cars.—The Tramways Committee has approved of separate services of railless cars being run between Bolton Woods and Frizinghall, and of the overhead wires in Canal Road being doubled, at an estimated cost of £250.

Alderman Enoch Priestley, chairman of the Tramways Committee, has been elected a member of the Town Planning Sub-Committee, because of the importance which is attached to the proper and adequate provision of tramways in the new areas when they are planned out.

Burnley.—Whitley Committee.—The principle of a Joint Works Committee, on the lines of the Whitley Report, has been accepted at Burnley. The new body will consist of five members of the Tramways Committee and five representatives of the Tramway and Vehicle Workers' Union; before its decisions become operative they must be approved by both the Committee and the Union.

Bury.—Extensions.—The T.C. proposes to reconstruct two tramway routes and to purchase 13 new tramcars, at a total cost of £139,200.

Canada.—Toronto.—"P.A.Y.E." Cars.—The "pay-as-you-enter" tramcars have been placed on several sections of the Toronto Street Railway.

Continental.—Belgium.—The Brussels tramway service was resumed on February 1st, following the settlement of the strike.

France.—The Compagnie des Chemins de Fer d'Orleans has applied for the reservation of most of the water power of the River Dordogne, in view of the construction of the Bordeaux to Geneva line.

Spain.—The municipality of Valencia has taken over the control of the tramways, to put an end to the strike, and troops are running the services.

Doncaster.—Proposed Extension.—After members of the Tramways Committee had visited the proposed new tramway route to Rossington, the engineer was requested to report on an alternative route.

Dover.—Extension of Time.—The B. of T. has granted an extension of time for the construction of the light railway from Dover to St. Margaret's and Martin Mill.

Hull.—Extensions.—The Corporation has decided to extend the tramway routes to Newland Park and Lee's Homes, and along Waterworth Street. It has also decided to apply for powers to extend the tramways to various places within a five-mile radius. The Tramways Committee is inquiring into the practicability of constructing a tramway along the Humber side.

Liverpool.—New Plant.—It is proposed to spend half a million on new plant for the improvement of the tramway service and the purchase of motor-'buses.

The T.C. has agreed to the recommendation of the Tramways and Electricity Committee that application be made to the L.G.B. for sanction to borrow £200,000 for generating plant and £190,000 for electric mains.

Rate Relief.—The T.C. proposes this year to appropriate for the relief of the rates, £140,000 from the surplus of the tramways department, against £125,000 last year, and £50,000 from the electricity department, against £65,000.

London.—New Junctions.—The L.C.C. Highways Committee has recommended the construction of junctions on the tramway system at Stockwell and Tooting, at a cost of £6,945.

Proposed Omnibus Services.—The Committee has also recommended the Council to consider the provision of omnibus services to connect up the tramway system.

Depôt Equipment.—The Committee has sanctioned the expenditure of a sum not exceeding £700 for the erection of overhead equipment at the Evelyn Street Depôt.

Underground Railway Strike.—At a meeting between the Railway Executive Committee, representatives of the men's Union, and the President of the Board of Trade on Thursday, last week, it was agreed that, pending further negotiations on the 12th inst., the men should return to work on the understanding that they should be booked on for eight hours' work, exclusive of meal times, but that all reasonable facilities to meet the needs of the men would be afforded by the companies. This officially terminated the strike, but the N.U.R. introduced further complications, and it was Sunday afternoon before a restricted service was commenced; and on Monday it was still not normal. Owing to the prolonged frost, it took 16 hours to raise sufficient steam at the Lots Road generating station, and several hours were occupied in thawing out brake blocks on the trains; in places the points on the track were also frozen.

District Railway Accidents.—Two accidents on the District Railway caused inconvenience on Monday. In the early evening a train going east stopped in the tunnel between Aldgate East and St. Mary's (Whitechapel) Stations. Traffic was stopped on the line for some hours. Later in the evening a train going westward was derailed at almost the same spot. At 10 o'clock both lines were blocked. The first accident is said to have been caused by a live rail defect and the second by a broken carriage axle.

Maidstone.—Proposed Extension.—The T.C. has engaged Mr. C. C. Hawtayne as consulting engineer, with reference to the proposed extension of the tramways to the North Ward and to Chatham, at an estimated cost of £200,000.

Manchester.—Proposed Tube Railways.—A private meeting of business men was held on February 8th to revive the project for constructing tube railways in Manchester. The scheme was favourably considered, and substantial financial support was promised.

Northampton.—Frozen pipes at the Corporation electricity works are said to have delayed the running of the tramways on Monday morning.

Romney Marsh.—Proposed Light Railways.—A conference of local bodies is to be held at Ashford (Kent) on March 11th, to consider the construction of light railways from Ashford to New Romney, *viâ* Bilsington and Newchurch, and from New Romney to Hythe.

St. Helens.—Municipal Purchase.—The negotiations between the T.C. and the Tramways Co., for the purchase of the system by the Council, have been settled in principle, but the questions of track repairs and the disposal of the tramcars have not yet been decided.

Stockton.—Tramway Bills.—The R.D.C. has decided to oppose the tramway bills of the Stockton and Middlesbrough Corporations, so far as they affect the Council's area.

United States.—Tramcar Robberies.—An up-to-date highwayman has been terrorising the inhabitants of Brooklyn, New York, by boarding tramcars in lonely districts and holding-up the occupants with a revolver. After robbing the driver, conductor, and passengers, the man escapes on a motor-car, which has been following the tramcar. So far, three cars have been held up in this manner, without any clue being obtained by the police.—*Daily Telegraph.*

Warrington.—Track Reconstruction.—The Tramways Committee proposes to convert the present single line on the Sankey and Cemetery routes into a double track.

TELEGRAPH AND TELEPHONE NOTES.

Cable Delays.—The Eastern Telegraph Co. states that, owing to cable interruptions and the very heavy increase in traffic, abnormal delay is at present unavoidable. Before the outbreak of war there were nine lines of communication between the United Kingdom and India, the Far East, &c., six by the Eastern Co., two *via* the Indo-European Co., and one by the Great Northern Co. The two latter companies carried a large amount of the Indian and Far East traffic, but these lines, which passed through Germany and Russia, have been interrupted since August, 1914, and all the traffic has been thrown on to the Eastern route. Of the six Eastern Co.'s cables from Porthcurnow, Cornwall, two are at present interrupted, and while everything possible is being done to effect repairs, the weather for more than two months has rendered it difficult for the cable ships to work; the cable ships are standing by the breaks awaiting favourable conditions. The traffic on the Eastern Co.'s lines, compared with 1913, has increased by 150 per cent., chiefly accounted for by Government telegrams, which have to be transmitted in priority to all other traffic, and by the increase in the average number of words in commercial messages, *i.e.*, from 12 in 1913 to 21 in 1918. Since the Armistice the Government traffic has still further increased, and now practically occupies the total capacity of one-and-a-half cables.—*Daily Telegraph.*

New Wireless Service.—A direct wireless service is shortly to be established between the American Mission in Vienna and Paris.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Sydney.—April 28th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

May 19th. Municipal Council. Boiler-house equipment. Specifications, on February 17th, from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. See "Official Notices," Jan. 31st.

Melbourne.—March 4th. Deputy Postmaster-General. Cables (schedule No. 1,504).*

March 10th. City Council. One 5,000-kw. frequency changer, high-tension switchgear. Specification (£1 1s.) from City Electrical Engineer.

*A copy can be seen at the Inquiry Office of the Department of Oversea Trade (Development & Intelligence), London.

Aylesbury.—Corporation Electricity Department. One 1,000-kw. generating set complete; two 500-kw. rotary converters. See "Official Notices" to-day.

Belfast.—February 15th. Tramways Committee. Tramway stores (including several electrical items). See "Official Notices" January 31st.

February 24th. Electricity Department. Electric and hand cranes, pumps and tanks. See "Official Notices" January 17th.

Birmingham. — March 5th. Tramways Committee. Additional rolling stock. See "Official Notices" February 7th.

Dundee.—February 14th. Corporation. Electric power installation at Corporation yard, East Dock Street. Specification from Mr. J. Thomson, city architect, 91, Commercial Street.

February 24th. Tramways Committee. Stores for one year, including several electrical items. Town Clerk.

King's Lynn.—March 3rd. Corporation. One 1,000-kw. turbo-alternator, one 400-kw. rotary converter or motor-generator, and one 400-kw. transformer and switchgear. See "Official Notices" February 7th.

Lincoln.—March 5th. Corporation. Four water-tube boilers with stokers, &c., complete; two 3,000-kw. turbo-alternators with condensers, &c.; extension of E.H.T. switchboard, &c.; two 750-kw. rotary converters, &c.; two 2,000-k.v.a. three-phase transformers, &c. Specifications from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. See "Official Notices" Feb. 7th.

London.—Stepney.—February 20th. Electricity Supply Committee. Two water-tube boilers, with chimneys; economisers, fines, &c. See "Official Notices" February 7th.

Hammersmith.—The Electricity Committee recommends that tenders be invited for 6 or 12 months' supply of stores including electric light sundries, insulated wire, jointing materials, joint boxes and connections, &c.

Manchester.—February 17th. Tramways Committee. Electric tramcar bodies. Specifications, &c., from Mr. J. M. McElroy, general manager.

Mansfield.—Corporation Electricity Committee. 1,250-1,500-kw. turbo-alternator, condensing plant, 500-kw. rotary converter, transformer, and switchgear. See "Official Notices" to-day.

New Ross (Co. Wexford).—February 20th. Gas and Electricity Supply Co., Ltd. Suction-gas plant and dynamos, storage battery, main switchboard, overhead lines and street lamps. See "Official Notices" January 24th.

Portsmouth.—March 4th. Tramways Committee. Tramway stores for six months. See "Official Notices" to-day.

Rhondda.—March 5th. U.D.C. Electricity Department. Twelve months' supply A.C. meters, cable, joint boxes, compound cut-outs, &c. See "Official Notices" to-day.

Taunton.—Electricity Department. One 500-kw. steam turbine generator, travelling crane, cables and meters. See "Official Notices" to-day.

Tuamgraney, Scariff (Co. Clare).—February 15th. Messrs. Lysaghts. One hydraulic turbine, dynamo, pipe line, electric motors and wiring. Specifications from Mr. L. J. Lawless, Rathmines, Dublin. See "Official Notices" January 31st.

CLOSED.

Batley.—T.C. Three electric motors and fittings at the sewage works. Messrs. Ward & Co.

Bradford.—Electricity Committee. Accepted:—
Five-ton hand-operated travelling crane.—Herbert Morris, Ltd.

Tramway Committee:—
One 9½-in. centre lathe, £310.—Ward, Haggas & Smith.
Emery wheels, £52 10s.—Robson & Co., Ltd.
Point fittings, £40.—Hadfields, Ltd.
Point springs, £6 15s.—Edgar Allen & Co., Ltd.

Sheffield.—Tramways Committee. Recommended:—
50 double-decked top-covered vestibuled tramcar bodies and trucks, £102,500, plus 5 per cent. for contingencies.—Brush Electrical Engineering Co., Ltd.

Walsall.—Electricity Committee. Accepted:—
New traction rotary, £3,439.—British Thomson-Houston Co., Ltd.

FORTHCOMING EVENTS.

Electro-Harmonic Society. — Friday, February 14th. At 7.30 p.m. At the Holborn Restaurant (Venetian Chamber). Ladies' night.

Physical Society of London.—Friday, February 14th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Annual general meeting.

Royal Society of Arts.—Monday, February 17th. At 4.30 p.m. At John Street, Adelphi, W.C. Cantor lecture "Scientific Problems of Electric Wave Telegraphy," by Dr. J. A. Fleming, F.R.S.

Wednesday, February 19th. At 4.30 p.m. At John Street, Adelphi. Paper on "The Use of Electricity in Agriculture in Germany," by Dr. J. F. Crowley.

Junior Institution of Engineers (N.E. Section).—Tuesday, February 18th. At the Mining Institute, Newcastle. At 7.15 p.m. Paper on "High-tension Transmission Lines, Overhead and Underground," by Mr. G. S. Lisle.

Industrial and Reconstruction Council.—Wednesday, February 19th. At the Saddlers' Hall, Cheapside, E.C. At 4.30 p.m. Lecture on "The Responsibility of Trade Unions in Relation to Industry," by the Rt. Hon. J. R. Clynes, M.P.

Liverpool Engineering Society.—Wednesday, February 19th. At the Royal Institution, Colquitt Street. At 8 p.m. Paper on "Boiler Mountings," by Mr. J. Purves.

Chemical Society.—Thursday, February 20th. At 8 p.m. At Burlington House, Piccadilly, W. Ordinary Scientific meeting.

Institution of Electrical Engineers.—Thursday, February 20th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Lecture on "Dielectrics in Electric Fields," by Mr. G. L. Addenbrooke.

Belfast Association of Engineers.—Thursday, February 20th. At 7.45 p.m. At the Municipal Institute. Paper on "Strength and Stiffness of Flat Plates," by Prof. F. H. Hummel.

Institution of Mechanical Engineers.—Friday, February 21st. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Annual general meeting. Adjourned discussion on "Electric and Oxy-Acetylene Welding."

Manchester Association of Engineers.—Saturday, February 22nd. At 6.30 p.m. At the Grand Hotel. Paper on "Hardness Determination of Metals," by Prof. C. A. Edwards.

Birmingham and District Electric Club.—Saturday, February 22nd. At 6.30 p.m. At the Grand Hotel. Annual dinner and concert.

Greenock Association of Electrical Engineers.—Saturday, February 22nd, Visit to Brown & Polson's Corn Flour Works, Paisley.

NOTES.

Ministry of Commerce.—The *Daily News* Lobby correspondent states that the Ministry of Commerce will be the name given to the Board of Trade after the Railway Department has been transferred to the new Ministry of Ways and Communications (Transport). The Commerce Ministry, after this change, will be concentrated on commerce and industry, and steps will be taken to link it up with bodies representative of commercial interests.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The following is the official programme of papers for the second half of the session 1918-19 :—

February 13th.—Lieut.-Colonel W. A. J. O'Meara, "The Functions of the Engineer: his Education and Training."
February 20th.—G. L. Addenbrooke, lecture on "Dielectrics in Electric Fields."
February 27th.—Paper or papers on "The Co-ordination of Research in Works and Laboratories."
March 6th and 13th.—G. L. Addenbrooke, lectures on "Dielectrics in Electric Fields."
March 20th.—Discussion on Mr. Addenbrooke's Lectures.
March 21st.—At 8 p.m. Joint meeting and discussion with the Royal Society of Medicine (Electrical Section), at 1, Wimpole Street; W. Papers by Mr. R. S. Whipple on "Some Notes on Electrical Methods of Measuring Body Temperatures," and "Some Notes on the Electro-Cardiograph."
March 27th.—Dr. S. F. Barclay and Dr. S. P. Smith, "The Determination of the Efficiency of the Turbo-Alternator."

Other arrangements for the remainder of the session (details of which will be announced later) include the following :—

Lecture by Dr. C. Chree on "Magnetic Storms."
Joint meeting and discussion with the Iron and Steel Institute; papers on "Electric Furnaces."
Mr. S. Chapman, "Electrical Phenomena Occurring in High Atmospheric Levels."

On February 20th and March 6th and 13th, Mr. G. L. Addenbrooke will give a series of lectures on "Dielectrics in Electric Fields," in the course of which he will show that there is not much probability of our obtaining insulating materials of lower capacity; the important influence exerted by moisture on the losses in dielectrics, and on the effects of temperature changes, will be dealt with in considerable detail.

Society of Arts.—Dr. J. A. Fleming delivered the first of three Cantor Lectures on "Scientific Problems of Electric Wave Telegraphy," in the theatre of the Society, on Monday. After calling attention to the great advance in Hertzian wave telegraphy, he described the characteristics and rate of travel of waves in various mediums. Among the pictures illustrating wireless telegraphy shown on the screen were some of the station at Nauen, near Potsdam. At Tuckerton, in America, the station had been in German hands, and some of the best German operators had been employed there to carry out a cunning fraud by which messages were handed in of so apparently harmless a nature that they passed the censor, their significance being imparted to the enemy by the ingenuity of the operator in superimposing a code word. But the trick was detected, and the station was taken under American control.

Volunteer Notes.—Royal Engineers Volunteers, London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 7, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Wednesday, February 19th.—Drill and Military Engineering, 1830, for the whole Corps.
Friday, February 21st.—Range, 1830.

C. Higgins, Captain, R.E., *Adjutant.*

County of London Royal Engineers (V.) Signal Units.—On Saturday evening last, at the Dean Hotel, Oxford Street, a Corps dinner was held, followed by a concert. Major H. C. Gunton, Officer Commanding, presided, and there was a large attendance, including many officers and friends of the Corps. After the toast of "The King," proposed from the chair, Regimental Sergeant-Major Stone, R.E., proposed "The Visitors" in a neat speech, and Mr. W. Noble (Assistant Engineer-in-Chief, G.P.O.), responded, recalling the days when he was himself a sub-commandant of the Corps. The toast of "The Corps" was proposed by Major Preston, who referred to the excellent work that the Corps had done in training members of other Volunteer Corps, and to the important duties which had been assigned to it on the lines of communication. Responding, Major Gunton reviewed the history of the Corps since its formation on the outbreak of war, when Major Preston was the first adjutant, and made special mention of the valuable assistance afforded by Mr. Brown as technical adviser, Mr. Parsons as transport officer, and Major Purvis, as well as many other former officers and friends. An excellent programme was provided, including an amusing topical song by Capt. Wells, R.E. (V.), and the function was thoroughly enjoyed.

Concert.—The Bradford tramway men's annual concert took place last week in the St. George's Hall.

Breaking Lamp Globes.—Two boys were fined 20s. and 10s. respectively at Wallasey, last week, for breaking electric globes on the promenade.

Fatalities.—Mr. James Patterson, of Blackpool, aged 23, in the employ of Messrs. Jones Bros., electrical engineers, Blackpool, has died as the result of a fall whilst engaged in erecting electrical machinery at the Calder and Mersey Extract Works, Ditton.

Industrial Training.—The Minister of Labour has issued a statement to the effect that in view of the importance of providing industrial training such as is required by large numbers of the demobilised members of H.M. Forces and civilian war workers who are being set free from their war occupations, the Government has decided to set up a special Department of the Ministry of Labour to deal entirely with questions of industrial training. The Minister has appointed Mr. James Currie, C.M.G. formerly Director of the Munitions Training Section of the Labour Supply Department of the Ministry of Munitions, Controller of the new Department.

This Department will not only administer various schemes for the vocational training of discharged soldiers and sailors, of civil war workers of either sex, and of women who are being discharged from the various auxiliary corps, but will, in due course, take over from the Ministry of Pensions the training of disabled men, with the exception of those who require medical supervision or training of a curative nature.

Further, the new Department will lay down the general lines upon which the training of serving soldiers and of men in hospital will be carried on.

Representatives of the Trade Unions and employers will be consulted in regard to the proposed systems of training, so as to receive their advice and co-operation in the work of the Department. Arrangements are also being made to ensure the interest of local authorities in all training work.

Welcome Home! in the United States.—The Society for Electrical Development and other American organisations are co-operating to give an electrifying welcome to all who have been with the Colours; electricity has become the generally accepted and employed medium for expressing the welcome that all feel in their hearts, and the flooding of streets and shop windows with light without stint is having a salutary effect upon the spirits of all. Many of the signs and devices which are being employed are of a character to ensure their permanency for a long time to come. On the front of the Rivoli Theatre in New York City, for instance, there is a cluster of myriad lamps so grouped as to flash out the Allied emblems in all their glorious colours, over which is the American eagle guarding a shield. On the Union League Club there is a great electric sign which blazes forth this message :—"Welcome Home to the Boys from Over There."

Some idea of the scale on which the plan of welcoming the boys home electrically is being carried out, can be had from these facts regarding the equipment that is being installed for the *New York Times* building, which consists of over 5,000 10-watt lamps, distributed as follows :—The entire building will be outlined with 300 2-ft. stars, each star containing 11 lamps, alternating red, white, and blue on a flasher. On the 43rd Street side, facing Times Square, will be a cluster of Allied flags, surmounted by a spread-eagle holding the American shield. This display utilises 1,000 lamps, and will measure 40 ft. wide by 24 ft. high. The flags will have a waving effect, and over this will be an electric sign reading "VICTORY," in 6-ft. letters. At each of the four entrances of the building will be a pair of crossed American flags waving; these will contain 250 lights each. On the roof will be four flash-lights illuminating the American flag flying from the flag staff.

Individual dealers who have neither the facilities nor the means to make a big display, have utilised their windows as the basis for their share in the generally expressed welcome.

Appointments Vacant.—Lecturer in electrical engineering (£300) for the University College, Nottingham; foreman jointer for the Mexborough U.D.C. electricity department. See our advertisement pages to-day.

Strikes in London.—In our last issue we carried the history of the strikes up to Wednesday; the Government had issued a regulation making interference with the public supply of electricity a penal offence, and on Wednesday the executive of the E.T.U. met to consider the position, but refused to make any public statement. Transport of some 40,000 persons was provided by means of motor cars and lorries, and preparations had been made to keep trains running on the main-line railways in the event of a national strike being declared.

On Thursday, goods drivers on the Brighton system were called out by the secretary of the Locomotive Engineers' and Firemen's Union, after he had obtained interviews with Sir Albert Stanley and Sir Robert Horne by threatening to call a national strike. On Thursday night the tube strike was settled, so far as this union was concerned, but the resumption of traffic was delayed, and on Friday afternoon the National Union of Railwaymen, which had originally denounced the strike, recognised it as official; as many of the employés at Lot's Road power station belonged to the N.U.R., the result was that the tube service was not resumed.

On Thursday evening the electrical strike should have commenced, but, while a number of men ceased work, those connected with the supply of electricity remained at their posts, with few exceptions. The E.T.U. leaders announced that the real strike would begin at Friday midnight, but on Friday the strike was declared "off," pending consideration by the national executive at Manchester on Sunday.

On Friday evening a lengthy meeting was held at the offices of the Electrical Trades Union, and the following statement was subsequently issued :—

That owing to a special extraordinary meeting of the Executive Council having been convened to sit on Sunday next to consider the question of national action to secure a 40-hour week, and, further, owing to the extraordinary change in the attitude of the Government in first refusing to intervene, and then intervening to safeguard the interests of the capitalists by suspending the civil rights of trade union members, we order an immediate resumption of work pending national action.

We further state that this instruction in no way affects the position of the men on strike in the Port of London.

In the small hours of Saturday morning an agreement was reached between the N.U.R. and the railway management, and the railway strike closed; but for some reason which was not disclosed, though a variety of obviously inadequate explanations was issued, the Lot's Road station was unable to give an adequate supply of electricity for the service of the tube railways until Sunday afternoon. On Wednesday this week the conference between the railway unions and the Government was to take place.

It is interesting to record, in addition to the resolution of the Electrical Power Engineers' Association to maintain the public supply of electricity with the aid of voluntary labour, that the National Association of Supervising Electricians offered its services to the Government. On Thursday afternoon the offer was accepted, and on Friday, at two hours' notice, a large number of the members assembled in readiness to take duty in the power stations. Fortunately, the strike did not mature. The Association of Engineers-in-Charge on Saturday passed the following resolution unanimously: "That this meeting of skilled plant engineers place their services at the disposal of the Government to further secure the continuity of the electrical supply of London, and, further, that they condemn the unlawful action of a section of a trade union in inciting the honest members of the union to break the law, and to cause discomfort to the population of the Metropolis by attempting arrogantly to dictate to the Government."

Electricians employed by private firms, who went on strike on Thursday evening, presented themselves for work on Saturday morning, but in many cases found the shops closed till Monday.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Burton-on-Trent Electricity Committee has increased the engineers' wages at the Corporation electricity works as follows:—Mr. C. J. MELBOURNE, £19 per annum, making total salary and wages £330; Mr. S. MELLOR, £16, total £246; Mr. G. A. VOWLES, £18, total £246, and Mr. A. WAKEFIELD, £18, total £246.

The salary of Mr. S. D. JONES, electrical engineer to the Batley Corporation is to be advanced by £25 per annum.

Dewsbury Corporation has deferred for a month consideration of the applications for increases of salary to Mr. R. H. CAMPION, the Corporation electrical engineer, and Mr. R. W. GRUBB, the assistant engineer.

Walsall Electricity Committee recommends that the salary of the engineer and manager of the electric supply department be increased from £500 per annum to £650 per annum.

Mr. E. G. BAKER, chief assistant engineer to the Morecambe Corporation, is now sufficiently recovered from his wounds received at Ypres in 1917, to enabel him to recommence his duties at Morecambe, and hopes to be back there in a few days.

Canterbury Town Council has advanced the salary of the city electrical engineer, Mr. BLASCHECK, by £67 a year.

On February 6th, Mr. E. W. BAILEY, of the Poplar electricity department staff, was presented with a clock and bronze set by the staff and workmen of the Council on the occasion of his marriage. The Town Clerk presided, and the presentation was made by Mr. J. Horace Bowden, the borough electrical engineer. Among those present were Messrs. Tait, Cruickshank, Ingram, and the available staff and workmen of the electricity works.

Wolverhampton Corporation has fixed the salary of Mr. C. THOMAS SILVERS, the tramways manager, at £600 a year.

Wolverhampton Corporation Electricity Committee proposes to appoint Mr. T. A. G. MARGARY distribution superintendent at the electricity works, at £300 per annum (without bonus) to fill the vacancy caused by the resignation of Mr. T. Smith.

Dublin Corporation Electricity Supply Committee has appointed Mr. J. L. KETTLE, deputy city electrical engineer, to the chief engineership, in place of Mr. Mark Ruddle, resigned, for a term of six months, at £750 a year and war bonuses about £250.

There was strong opposition at Salford Town Council last week, when it was proposed to increase the salary of the tramway manager from £700 to £750 a year. Cr. Steele said that when only two-thirds of the service was running it was not the time to advance salaries. Ald. Linsley, Chairman of the Tramways Committee, said they had every confidence in the general manager, who was one of the most capable managers in the United Kingdom. The amendment was defeated by 30 votes to 14.

Mr. R. W. L. PHILLIPS has resumed the duties of borough electrical engineer at Bedford after 14 months' service in the Royal Air Force, and all communications for the electricity department should be addressed to him.

Mr. J. E. EDMUNDSON, A.M.I.E.E., who for the last 13 years has acted as engineer and manager to the Urban Electric Supply Co., Grantham and Stamford, has been appointed engineer and manager at the Hawick branch of the same company. He is to be succeeded by Capt. F. H. Brandreth, A.M.I.E.E., who for the last seven years has been resident engineer to the same company at Stamford.

Mr. W. F. ANDREWS, on his release from the Army, has resumed his duties as draughtsman and mains assistant to the Stepney Borough Council. He joined the London Electrical Engineers, R.E. (T.) at the commencement of the war, and later was appointed staff sergeant to a R.G.A. anti-aircraft company on the London barrage.

Mr. W. SANDERSON, who has been appointed superintendent at the Fochabers generating station, was the recipient of an illuminated address recording the high esteem in which he was held in the district, where he has successfully carried through the new scheme of public lighting, and a cheque for £26, from the residents of Uphall, West Lothian, on the occasion of his resignation of his position as engineer to the Uphall special lighting district.

Mr. F. SMITH, chief electrician to the Pinxton Colliery Co., has been presented with an eight-day marble and bronze timepiece, with bronzes to match, from the officials and workmen of the company, on the occasion of his recent marriage. Mrs. Smith was also presented with a case containing a solid silver sugar basin, cream jug, and tongs.

Leek T.C. has increased the salary of Mr. F. SWARBRICK, engineer and manager of the electricity department, to £350 per annum.

General.—After three years' service at Woolwich as the inspector of empty fuses, controlling a staff of 50 officers and over 12,000 examiners, Mr. FRANCIS R. WADE, O.B.E., has returned to his practice as consulting engineer at Birmingham and the Inner Temple, London.

Mr. S. EVANS, who has been demobilised after serving with the London Electrical Engineers since 1916, has returned to Messrs. D. Hulett & Co., Ltd., of High Holborn, W.C.1, as assistant manager to the company, and as manager of the electrical department.

The many friends of Mr. W. R. RAWLINGS will be glad to learn that having safely undergone a serious operation, he is now recuperating at Bournemouth.

Mr. C. J. MARGERISON, manager of the electrical department of Messrs. W. Geipel & Co. for the past ten years, has resigned his position, and joined Messrs. F. J. Shenton and Co., Ltd., electrical engineers, of New Cross, S.E.

Mr. C. F. SPENCER, Director-General of the National Kitchens Division of the Ministry of Food, is resigning his position, in order to be able to devote closer attention to his own business.

Mr. H. A. MCGUFFIE (of Messrs. Stevenson & McGuffie, Glasgow), who has been seriously ill since the end of December, expects to return to business about the end of this month.

Mr. A. BLONDEL has been appointed an Officer of the Legion of Honour.

Mr. G. H. NASH, C.B.E., M.I.E.E., has terminated his war appointment of hon. technical adviser to the Admiralty experimental station, Portland, and has resumed his position as chief engineer of the Western Electric Co., Ltd.

Congratulations to Sir WILLIAM SLINGO, engineer-in-chief to the G.P.O., who has been created a Chevalier of the Order of Leopold by the King of the Belgians.

The King of the Belgians has conferred the Order of Leopold II. upon Mr. F. W. EMETT, head of Reuter's intelligence branch in London, in recognition of help given to Belgium during the war.

Mr. L. B. BEALE has been appointed H.M. Trade Commissioner at Winnipeg. He is at the Department of Overseas Trade in London until towards the end of February.

The *Times* states that Mr. W. NOBLE, assistant engineer-in-chief, G.P.O., has received from the King of the Belgians the decoration of Chevalier de l'Ordre de la Couronne.

Belfast Electricity Committee has appointed Sir JAMES JOHNSTON chairman and Councillor REDDELL vice-chairman.

Mr. H. G. W. HASLETT, late of Messrs. Haylock & Haslett, has now returned from active service in France. His temporary address is 93-94, Chancery Lane, W.C.

Mr. G. DUNCAN DEWAR, B.Sc., A.R.T.C., has accepted an appointment as manager of the electrical department of Messrs. James Pitkin & Co., Ltd., engineers and instrument makers, of 28, Hatton Garden, and Willesden, N.W. During the past three years Mr. Dewar has been an officer on H.M.S. *Vernon* and in H.M. Signal School, R.N. Barracks, Portsmouth, being engaged during his service with the Admiralty in the design and development of wireless telegraph apparatus for use in the naval service. Previously Mr. Dewar was a designer with the Lancashire Dynamo and Motor Co., Ltd. He will now devote particular attention to the development of Messrs. Pitkin's electrical branch.

Amongst the many employés of Messrs. C. A. Vandervell and Co. who have now returned to the firm to take up their old jobs is Lieut. ERNEST LEIGHTON, of the Royal Air Force, who joined the Army in 1914. Lieut. Leighton takes up his old position as manager of the installation department.

Mr. C. JONES, M.I.E.E., &c., chief electrical engineer, Cannock Chase Collieries, and consulting engineer to other concerns, has recently been appointed chief mechanical and electrical engineer to the Cannock Chase Colliery Co., Ltd.

Roll of Honour.—The Meritorious Service Medal has been awarded to First-Class Air-Mechanic H. HOLMES, who already holds the Military Medal and the Mons Star. He was formerly employed at the Warrington Corporation electricity works.

The following is an extract from the *London Gazette* for November 18th, 1918:—

"Reward for service in the field in connection with military operations in East Africa, to be dated June 3rd, 1918. To be a Member of the Most Excellent Order of the British Empire, FUGE, Capt. W. V. G., R.G.A. (Wireless Signal Service)."

Private P. COLEMAN, 1/8th Manchester Regt., who died of pneumonia on February 3rd, was employed by Messrs. Charles Macintosh & Co., Ltd.

Private H. TAYLOR, 37th Labour Battalion, who has died in hospital at Valenciennes from influenza, was employed by the St. Helens Cable & Rubber Co., Warrington.

Lance-Corporal J. A. BARLOW, M.G. Corps, previously an employé of the Stepney Borough Council electricity undertaking, has been awarded a bar to the Military Medal.

Second Lieutenant W. R. BAIRD, R.F.A. (Glasgow), who has been mentioned in dispatches, was engaged with the Clyde Valley Electrical Power Co.

Corporal R. WYLIE FARR, 1/5th Argyle and Sutherland Highlanders, who was wounded at Menin October 28th, 1918, has been awarded the Croix de Guerre with bronze star from the French Government, also the Military Medal. He is an employé of the Clyde Valley Electrical Power Co. (meter survey department).

The death is reported of Major D. F. COLSON, D.S.O., R.E., son of the late Mr. Alfred Colson (for many years head of the gas and electric department of the Leicester Corporation). He volunteered for service in the Boar War, in which he served as an electrical engineer, and was taken prisoner. On returning home he took a great interest in the Electrical Engineers' Volunteer Corps, and it was in connection with this body that he joined up when war broke out in 1914. For the past two and a half years Major Colson has seen service in Palestine, where he was in charge of the water supply. He was afterwards engaged in work in Alexandria. He was expected home on leave a few days ago. While on his way home he received orders to proceed with the building of a railway to Constantinople. He contracted pneumonia, and died on 3rd inst. Major Colson was about 40 years of age.

Obituary.—MR. W. CORDREY.—We regret to announce the death of Mr. William Cordrey, of 5, St. Mildred's Road, Lee, Kent, on January 28th, at the age of 58 years. Mr. Cordrey was a governing director of Messrs. W. H. Willcox and Co., Ltd., and a partner with Mr. W. H. Willcox in the original business. The funeral took place on February 3rd, at Lee Cemetery.

PROF. G. CAREY FOSTER, F.R.S.—We regret to record the death, which occurred at Rickmansworth, on Sunday last, of Professor George Carey Foster, F.R.S., J.P., in his 84th year. Prof. Foster became Professor of Physics at University College, London, in 1865, and he held that appointment until 1898, when he became Principal. He retired from that position in 1904. He was one of the founders and presidents of the Physical Society of London, and for several years was general treasurer of the British Association for the Advancement of Science.

NEW COMPANIES REGISTERED.

William Beal & Co. (1919), Ltd. (152,855).—Private company. Registered January 20th. Capital, £6,000 in £1 shares. To acquire the business of dealers in gas and electrical fittings carried on at 2, Hill Street, Birmingham, by Wm. Beal & Co., Ltd. The subscribers (each with one share) are:—A. Pritchett, Eagle House, King's Norton, Birmingham, managing director; W. B. Pritchett, Eagle House, King's Norton, Birmingham, bank clerk. The first directors are: A. Pritchett (chairman), W. B. Pritchett, and A. B. Pritchett. Registered office: 2, Hill Street, Birmingham.

W. J. Furze & Co. (Manchester), Ltd. (152,958).—Private company. Registered February 4th. Capital, £10,000 in £1 shares (9,900 ord. and 100 founders). Electrical engineers and contractors, suppliers of electricity, carriers, manufacturers of electric railway, tramway, and other apparatus, &c. The subscribers (each with one share) are:—W. J. Furze & Co., Ltd., Traffic Street, Nottingham; W. F. Furze, Holm View, Victoria Embankment, Nottingham, electrical engineer; C. J. Fox, Elmsthorpe, Maple Grove, Prestwich, near Manchester, electrical engineer. First directors: W. F. Furze and C. J. Fox.

Arthur Maxwell, Ltd. (152,903).—Private company. Registered February 1st. Capital, £100 in £1 shares. Electrical contractors and engineers, fitters, motor-car dealers and makers, &c. The subscribers (each with 50 shares) are:—J. Leitch, 6, Exeter Mansions, N.W.2; Mrs. S. M. Maxwell, 2, Fairhazel Gardens, Hampstead, N.W. First directors: Mrs. S. M. Maxwell and J. Leitch. Registered office: 2, Fairhazel Gardens, Hampstead, N.W.

British Electron, Ltd. (158,030).—Private company. Registered February 5th. Capital £60,000 in £1 shares. To take over the business of the British Electron Co., Ltd., and to carry on the business of manufacturers of hydraulically compressed iron and steel billets and tin ingots, metal refiners, de-tinners, smelters, engineers, importers and exporters of and dealers in metals, metal scrap, ores, and ferrous or non-ferrous substances, metallurgists, &c. The subscribers (each with one share) are:—H. D. Ashworth, Old Alley, Ellesmere Park, Eccles, metal refiner; D. Davies, Avondale, Ellesmere Park, Eccles, colliery director; A. Keating, 51, Stockport Road, Manchester, metal merchant; C. S. Adams, 127, Queen's Road, Cheetham, Manchester, metal refiner. The first directors are:—H. D. Ashworth, D. Davies, A. Keating, C. R. Adams, J. W. Binns, G. A. Bower, and E. Brierley. Solicitor: F. E. Osborne, 30, St. Ann Street, Manchester.

Northern Electric Wire Co., Ltd. (152,976).—Private company. Registered February 5th. Capital, £15,000 in £1 shares. To take over the business carried on at Sedburgh Mills, Halifax, as the Northern Electric Wire Co. The subscribers (each with one share) are:—J. Tetlow, The Royas, Cleckheaton, card manufacturer; J. P. Horley, The Hollies, Cleckheaton, card maker; E. Ellison Braemar, Cleckheaton, tar distiller; F. Walker Wynngrove, Cleckheaton, wire manufacturer. Subscribers appoint the directors. Registered office: Sedburgh Mills, Halifax.

Radi-Arc Electric Welding Co., Ltd. (152,977).—Private company. Registered February 5th. Capital, £200 in 1s. shares. To carry on oxy-acetylene, electrical, or other welding and re-welding in connection with machinery, apparatus, railway, motor, shipping, aircraft, and other appliances, or otherwise, &c. The subscribers (each with one share) are:—S. Miles, 30, Craven Park, N.W.10, clerk; Vera M. Huthwaite, 270, Southampton Street, S.E.15, shorthand typist; Caroline Miles, 30, Craven Park, N.W.10, clerk. First directors not named. Registered office: Regency House, 1, Warwick Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Commercial Telephone & Electrical Co., Ltd. (152,988).—Private company. Registered February 6th. Capital, £2,000 in £1 shares. As title. First directors: F. Gardner, 176, Hyderthorpe Road, Clapham Park, S.W.; A. H. Marshall, 43, Courtland Avenue, Ilford, Essex. Registered office: 16, Fenchurch Street, E.C.

Harry W. Cox & Co., Ltd.—Issue on January 22nd, 1919, of £500 debentures, part of a series already registered.

Bourne Valley Manufacturing Co., Ltd.—Debenture dated January 20th, 1919, to secure £1,395, charged subject to prior mortgage on property at Boscombe and the company's general assets. Holders: Cox & Co., 16, Charing Cross.

Burmah Electric Tramways & Lighting Co., Ltd. (75,080).—Capital, £200,000 in £5 shares (20,000 pref. and 20,000 ord.). Return dated January 14th, 1919. All shares taken up. £10,000 paid on the pref.; £100,000 considered as paid on the ord. Mortgages and charges: Nil.

Caerphilly Electric Supply Co., Ltd. (139,086).—Capital, £6,000 in 400 cum. pref. shares of £5 each, 1,500 pref. ord. shares of £1 each, and 2,500 ord. shares of £1 each. Return dated December 31st, 1918. 100 ord. shares taken up. Mortgages and charges: Nil. (To date of return, company had not commenced trading.)

CITY NOTES.

London Electric Railway Dividends.

Metropolitan District Railway Co.—Dividends on the 4 per cent. guaranteed stock for the last half-year 2 per cent., making 4 per cent. for the year; on the 4½ per cent. first preference 2¼ per cent., making 4½ per cent.; on the 5 per cent. second preference stock 3½ per cent., making 5 per cent. for the year, carrying forward £21,331.

Underground Electric Railway Co.—The full interest to December 31st on the 6 per cent. first cumulative income debenture stock is to be paid, and the full interest of 3 per cent., free of tax, on the 6 per cent. income bonds of 1948 for the half-year ended December 31st, carrying forward £36,700.

City and South London Railway Co.—Dividend on the Consolidated ordinary stock for the past half-year 1½ per cent., making 2 per cent. for the year, carrying forward £24,367.

London Electric Railway Co.—Dividend 2 per cent. for the past half-year on the preference stock, making 4 per cent. for the year; 1¼ per cent. on the ordinary, making 2 per cent. for the year, carrying forward £23,604.

Central London Railway Co.—Dividend on the undivided ordinary stock for the past half-year 2¼ per cent., making 4 per cent. for the year on the preferred ordinary; 2 per cent., making 4 per cent.; and on the deferred ordinary 4 per cent. for the year; carrying forward £17,485.

Crompton & Co., Ltd.

The report for the three years ended March 31st, 1918, states that the accounts for the year ended March 31st, 1916, have already been before the shareholders, and the figures now presented include adjustments in regard to capital expenditure for war purposes, depreciation, &c., for that year. The balance of profit and loss with the amount brought forward amounts to £121,959; after deducting allocations to reserve and dividends paid there is a balance of £86,605, subject to excess profits duty and munitions levy. From the above balance dividends for the year to March 31st, 1918, passed at the annual meeting in July must be deducted, leaving £76,550. The directors recommend placing £15,000 to reserve, carrying forward £61,560, subject

to excess profits duty and munitions levy. In view of the rise in cost of material and of labour, which necessitates for a given output an increased amount of working capital, and of the demand for goods of the company's manufacture, the directors consider it necessary to increase forthwith the capital of the company, and are further desirous of giving an opportunity to their employés of investing in the company's shares, such shares to have some preferential rights. A resolution is to be submitted to the shareholders to increase the registered capital from £221,007 to £500,000, of which 34,000 shares of £1 each will be preference shares, ranking *pari passu* with the existing preference shares of the company, and the balance will be ordinary shares. Subject to this resolution being approved by the shareholders, the directors propose to reserve the preference shares so created for issue to the employés of the company on the terms that the number of shares to be held by any one employé be limited, and that the holder of such shares, while in the company's employment, be entitled, in addition to such dividend as may be declared on the preference shares from time to time, to a bonus to be paid out of the profits of the company equivalent to 3 per cent. per annum upon the amounts paid up on such shares.

Dublin United (Electric) Tramways Co. (1896), Ltd.—The half-yearly report shows £117,492 available for division. Interim dividends in August absorbed £22,620, and a final dividend is now recommended at the rate of 6 per cent. per annum, making 5 per cent. for the year, with a bonus of 1s. for £10 unit of ordinary stock. The preference dividend is 6 per cent. for the half-year. £35,000 is put to deferred renewal of rails and cars, and £15,000 to general reserve, and £1,850 is written off investments, bringing them to present market values. Dividend, bonus, and sums set aside amount to £104,230, leaving £13,262 to carry forward. During the year 71,008,655 passengers were carried, the revenue being £443,401, as against 66,624,326 passengers and £383,838 in 1917.

Edison Swan Electric Co., Ltd.—Following upon the references to the required new capital for expansion purposes, the *Financial Times* says that the directors have now definitely decided to ask holders of the "A" shares to forego their cumulative preferential rights and, in addition, to permit the cancellation of their arrears. Under the scheme put forward the first preference will remain as at present, but the "A" and "B" shares will be converted into ordinary capital, and an emission of 150,000 such shares will then be made.

Vera Cruz Electric Light Power Co.—The report for the year to December 31st, 1917, states that the net profits in Mexico amount to £50,611. After meeting all expenses, debenture interest, and sinking fund charges there is an available balance of £38,266, plus £13,314 brought forward, making £61,581. The directors recommend a dividend of 7½ per cent. for the year, of which 5 per cent. has already been paid, to transfer £10,000 to depreciation and reserve, and to carry forward £15,331.

Metropolitan Railway Co.—Results for 1918:—Gross railway receipts £1,336,247, expenditure £906,565, miscellaneous receipts £194,261, total net income £623,943, plus £16,100 brought forward. Interest, rentals, and other fixed charges, and appropriations to renewals, absorb £308,910, dividends on preference stock £239,107. Dividend on the ordinary stock £1 5s. per cent. for the year, leaving £19,211 to be carried forward. £20,000 has been transferred to the general renewals fund.

City of Buenos Aires Tramways Co. (1904), Ltd.—The report to December, 1918, states that the annuity payable by the Anglo-Argentine Tramways Co., Ltd., has been received, and the net revenue for the year amounted to £67,839. Three interim dividends have been paid, and a final dividend of 1s. 3d. per share, making 5 per cent. for the year, less tax, is recommended, leaving £5,750 to put to general amortisation fund, and £89 to be carried forward.

Llandudno & Colwyn Bay Electric Railway, Ltd.—For the year ended November, 1918, the profit, after providing for expenses and debenture and loan interest, is £7,938, making with the balance brought forward £8,134. Of this £1,775 has been placed to sinking fund, £1,500 to renewals, leaving £4,859. A dividend at the rate of 4½ per cent. per annum, less tax, is to be paid, and £386 carried forward.

St. James & Pall Mall Electric Light Co., Ltd.—Balance dividend on the 7 per cent. preference shares for the half-year ending December 31st, 1918, of 3s. 6d. per share, and 6s. 6d. on the ordinary shares, making with the interim dividend paid thereon a total distribution of 10 per cent. for the year.

Cambridge Electric Supply Co., Ltd.—The total profit for 1918 was £7,312, plus £2,947 brought forward. After deducting debenture and other interest £1,748, and placing £1,500 to depreciation fund account, a dividend of 5 per cent. for the year absorbs £4,460, leaving £2,552 to be carried forward.

Parsons Marine Turbine Co., Ltd.—Interim dividend of 10 per cent., free of tax.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended December 27th, 1918, amounted to 2,000,352, compared with 1,946,348 units in the corresponding four weeks of 1917.

Central Electric Supply Co.—After transferring £22,253 to depreciation fund, £400 is written off for discount on issue of debenture stock, leaving a loss for 1918 of £7, which is deducted from the credit balance of £16 brought forward, leaving £9 to be carried forward.

Tottenham District Light & Power Co.—Dividends for the past half-year at the following rates:—5 per cent. on the preference stock, 4½ per cent. on the "A" stock, and 3 per cent. on the "B" stock, all less income-tax.

Telegraph Construction and Maintenance Co., Ltd.—In addition to the interim dividend of 5 per cent. paid in July last, a further dividend of 10 per cent., together with a bonus of 12s. per share.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List:—

Crompton & Co., Ltd.—Ordinary shares of £1 each, fully paid; preference shares of £1 each, fully paid; and £150,000 6 per cent. first mortgage registered debentures (£100 and £50).

International Light and Power Co.—Dividend of 16½ per cent., less British income-tax, on the preference shares for a period of 33 months in full payment of accrued arrears of dividend to December 31st, 1918.

National Gas Engine Co., Ltd.—Final dividend 3½ per cent. on ordinary shares, making 7½ per cent. for the year, and a bonus of 1s. per share, free of tax.

National Electric Supply Co., Ltd.—Net profits for 1918 £13,080, plus £160 brought forward; total, £13,240. Dividend 2s. 6d. per share, making 5s. for the year, carrying forward £242.

Marconi Wireless Telegraph Co. of America.—The financial Press announces a dividend of 5 per cent., less tax, on the capital stock.

Crossley Bros., Ltd.—Final dividend 4½ per cent. actual on the ordinary shares, making 7½ per cent. for the year.

STOCKS AND SHARES.

Tuesday Evening.

Some degree of normality having been established in the world of Tube railways, it is again possible for London to go about its business as before, and the Stock Exchange, like the rest of us, is able to resume work within ordinary hours. But the strikes made little difference to share prices in the railway lists. These are dividend markets to-day, and the unexpected declaration of a full 3 per cent. on the Income bonds of the Underground Electric Railways had a smart effect upon the price, sending it up with a rush to 97 before a point reaction took place. The dividend makes 5 per cent. for the year, but the 3 per cent. just announced is held to be a return to the 6 per cent. per annum rate, and at 96, cum div., the return works out to 6¼ per cent. on the money. As it is free of tax, this is equal to 9 per cent., less tax at 6s. in the £. We work out the dividend, in our tables overleaf, on the strictly correct basis of 5 per cent. for the year.

For the full year 1918, Central London deferred stock gets 4 per cent., as against 3 per cent. in 1917, and the London General Omnibus dividend is raised from 7 per cent. to 8 per cent. The City & South London, with the London Electric, pay 2 per cent. for 1918, a rise in each case of ½ per cent. on the year. District second preference will have 5 per cent. for 1918, a gain of 2 per cent. over 1917; the District carry forward of £21,300 is about £7,700 less than that in the previous twelvemonth, but the London General Omnibus carries forward £60,900, or £22,000 more than in 1917. Quotations for the Tube stocks have mostly moved up since a year ago, Districts, for instance, at 28½ going against 15½ in December, 1917, and Underground Incomes at 96 showing a rise of 14½ in as many months.

The St. James' & Pall Mall Co. has declared its dividend and the prices of the shares remains unaltered at 7½. The declaration was received with a certain amount of relief, because it is certainly better than was expected. Lively dealings have sprung up in Westminster Electric new shares. The old issue is quoted 6¾ ex rights, and the new are being dealt in on the basis of ½-¼ premium. City of London ordinary reacted to 12¾, but otherwise the list of electric lighting shares is steady. Edison & Swan "A"

shares have eased off to 18s. 6d. A good deal of curiosity is expressed as to what the definite proposals are likely to be for re-arrangement of the capital. Nothing further is known than was announced some weeks ago. It is thought in the market that the arrangements to be made may be a little less what some people call drastic in regard to the dividend on the "A" shares, but it is impossible to say yet precisely what scheme will be formulated. Meanwhile, it will be as well to accept unofficial statements with considerable reserve. General Electric ordinary lost 5s., but otherwise the manufacturing group is firm. Newcastle-on-Tyne Electric ordinary receded to 22s. 6d.

Few changes have occurred in the list of telegraphs and telephones. Globe ordinary fell 2s. 6d.; Eastern ordinary is a point higher; Telegraph Constructions are 10s. up, while Callenders went back to 10¾, a reaction of 5s. Marconis are quiet. American Marconis at 30s. have rallied a little from the weakness that occurred as a result of the dividend disappointment.

The foreign group continues irregular, Mexican Light and Power preferred advancing to 50, although the company's first mortgage bonds are another 2 points lower at 65¼. Canadian General Electrics have risen 3 to 118¾, and San Paulo Electric first mortgage bonds at 86 are higher. On the other hand, Vera Cruz debenture stock fell 4 points to 84.

There is not much doing in rubber shares, speculative interest in them having been diverted into the popular oil group. Armaments, with iron and steel shares, are better, probably on the settlement of some of the minor strikes that have occurred recently. Base-metal shares are steady, showing little movement one way or the other. The Government is expected to come to the aid of the tin mining companies in Cornwall, and, in consequence, a few of the leading shares have strengthened during the past few days.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Feb. 11, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	7¾	—	£6 15 7
Charing Cross Ordinary	5	4	3¾	—	5 10 4
do. do. do. 4½ Pref.	4½	4½	8¾	—	6 8 7
Chelsea	3	5	4	—	6 5 4
City of London	8	8	12½	— ¼	6 5 6
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
Kensington Ordinary	6	7	6	—	5 16 8
London Electric	Nil	Nil	1¾	—	Nil
do. do. 6 per cent. Pref.	4	5	4	—	6 5 0
Metropolitan	3	4	3	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	8½	—	6 18 6
St. James' and Pall Mall	8	9	7½	—	6 4 2
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6¾xd	—	6 11 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	98½	—	6 1 10
do. Def.	1½	1½	22	—	7 12 0
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 10 4
Eastern Extension	8	8	15½	—	*5 3 3
Eastern Tel. Ord.	8	8	158½	+1	*5 1 0
Globe Tel. and T. Ord.	7	7	14½	— ½	*4 19 1
do. do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	24	22	32	—	6 17 6
Indo-European	13	13	58	—	5 12 0
Marconi	15	20	42	—	4 6 7
Oriental Telephone Ord.	10	10	2½	—	4 0 0
United R. Plate Tel.	8	8	7¾	—	*5 1 7
West India and Panama	6d.	1/3	1¾	—	*3 17 6
Western Telegraph	8	8	16½	—	*4 16 3
Home Rails.					
Central London Ord. Assented	4	4	65½	—	6 2 2
Metropolitan	—	1	30	+ ½	4 3 4
do. District	Nil	Nil	27½	—	Nil
Underground Electric Ordinary	Nil	Nil	8¾	—	Nil
do. do. "A"	Nil	Nil	10/6	+9d.	Nil
do. do. Income	6	4	96	+1½	*5 4 2
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	42	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3½	—	—
do. do. 2nd Pref.	5½	—	3¾	—	—
do. do. 5 Deb.	5	5	71½	—	6 19 10
Brazil Tractions	—	—	55¾	—	—
Bombay Electric Pref.	6	6	10¾xd	+ ½	5 11 7
British Columbia Elec. Rly. Ptfce.	5	5	65½	—	7 12 8
do. do. Preferred	Nil	Nil	47	—1	Nil
do. do. Deferred	Nil	Nil	43½	— ½	Nil
do. do. Deb.	4½	4½	62	—	6 17 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	63½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	51	—	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	50	+1	Nil
do. 1st Bonds	Nil	Nil	65½	—2	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3¾	—	3 17 5
British Aluminium Ord.	10	10	1¾	—	5 10 5
British Insulated Ord.	20	20	2½	—	4 9 0
British Westinghouse Pref.	7½	7½	2½	— ⅛	6 0 0
Callenders	20	25	10¾	—	5 16 3
do. 6½ Pref.	5	5	5¾	—	5 2 4
Castner-Kellner	22	20	3⅞	—	5 16 3
Edison-Swan, "A"	—	—	16/6	—1/6	—
do. do. 4 per cent. Deb.	4	4	74½	—	5 6 0
Electric Construction	7½	10	1⅞	—	8 8 5
Gen. Elec. Pref.	6	6	10½	—	6 6 10
do. Ord.	10	10	17½	— ½	*5 14 3
Henley	25	25	2⅞	—	5 8 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17	—	*5 17 8
Siemens Ord.	10	—	6¼	—	*3 3 4
Telegraph Con.	20	20	49¾	+ ¼	*4 17 6

"A" * Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, February 12th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	...
a Ammoniac Sal	per ton	£80	...
a Ammonia, Muriate (large crystal)	"	£78	...
a Bisulphide of Carbon	"	...	...
a Borax	"	£48	...
a Copper Sulphate	"	£50	£10 dec.
a Potash, Chlorate	per lb.	1/9	3d. dec.
a " Perchlorate	"	1/9	...
a Shellac	per cwt.	£13 10s.	10s. dec.
a Sulphate of Magnesia	per ton	£15	...
a Sulphur, Sublimed Flowers	"	£33	...
a " Lump	"	£25	...
a Soda, Chlorate	per lb.	11d.	½d. inc.
a " Crystals	per ton	£7	...
a Sodium Bichromate, casks	per lb.	...	...
METALS, &c.			
c Brass (rolled metal 2' to 12' basis)	per lb.	1/1⅝	...
c " Tubes (solid drawn)	"	1/3½ to 1/3¾	½d. dec.
c " Wire, basis	"	1/3	...
c Copper Tubes (solid drawn)	"	1/5¾ to 1/6½	½d. dec.
g " Bars (best selected)	per ton	£132	...
g " Sheet	"	£132	...
g " Rod	"	£132	...
d " (Electrolytic) Bars	"	£100	£5 dec.
d " " Sheets	"	£161	...
d " " Wire Rods	"	£110	£5 dec.
d " " H.C. Wire	per lb.	1/1¾	½d. dec.
f Ebonite Rod	"	3/-	...
f " Sheet	"	2/6	...
n German Silver Wire	"	2/6	...
h Gutta-percha, fine	"	11/-	...
h India-rubber, Para fine	"	2/5½	½d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	...
l " Wire, galv. No. 8, P.O. qual.	"	£40	...
g Lead, English Pig	"	...	...
g Mercury	per bot.	Nom.	...
e Mica (in original cases) small	per lb.	9d. to 4/6	...
e " " " medium	"	5/- to 10/-	...
e " " " large	"	12/6 to 25-/& up.	...
d Silicium Bronze Wire	per lb.	1/7	...
r Steel, Magnet, in bars	per ton	...	...
g Tin, Block (English)	"	£224	£19 dec.
n " Wire, Nos. 1 to 16	per lb.	4/-	...

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
r W. F. Dennis & Co.

New Belgian Companies.—Among the new companies recently formed in Belgium in connection with the generation and distribution of electricity are the Société de la Centrale Electrique de Leignon, formed at Leignon, and the Société Co-operative Centrale Hydro-electrique des Grands Etangs, of Cierreux-Rovigny.

Safety First. — As evidence of the necessity which exists for immediate action, the latest published returns show, says the British Industrial "Safety First" Association, that in 1914 969 persons were killed and 147,045 were injured by accidents in workshops and factories alone, a large proportion of which would, undoubtedly, have been prevented had those who became casualties been educated in matters pertaining to their own safety. Millions of pounds paid in compensation, and huge sums of money lost to workers as wages, might have been saved and utilised to better advantage, and untold suffering have been obviated. The aim of the Association is to render the industrial community "Wreckless, not Reckless."

Electrically Illuminated Christmas Tree in War Zone.—Coblenz saw its first electric Christmas tree on Christmas Eve. It was set up in the plaza along the Rhine, directly in front of the headquarters of the Third Army. The tree, which was 40 ft. high, was decorated with red, white, and blue ribbons and was trimmed by Army nurses. It was placed in position by members of the Thirty-Seventh Engineers. Red, white, and blue incandescent lights covered the tree, at the base of which, in letters 3 ft. high, were the insignia of the Third Army. The electricity was furnished by a portable plant taken to the spot by American troops. The Seventy-Third Field Artillery gave a concert when darkness fell and the tree was lighted up. The large building housing the headquarters of the Third Army, as well as smaller structures erected by American troops, all bore crosses, which were lighted the evening before Christmas and on Christmas evening.—*American Electrical Review.*

L.C.C. Elections.—In an address to members of the Constitutional Club, last Friday, Lord Downham said that there was very little divergence of policy, programme, or feeling between the Municipal Reform Party and the Progressives. He said that they both aimed at raising the general standard of life and happiness of London citizens. Both had a forward policy with regard to housing, health, tramways, and electricity in bulk, and they desired the L.C.C. to be a model employer of labour.

PARALLEL CONNECTION AND VOLTAGE REGULATION OF LARGE MERCURY RECTIFIERS.

Where transformers, motors, and generators are concerned there must be a whole series of designs and sizes to suit various output requirements, and different supply voltages and frequencies, but this is not the case when mercury rectifiers are concerned. The range of conditions which necessitates 20 or 30 patterns of transformers may be covered by two or even by a single type of rectifier. The modern high-power mercury rectifier consists essentially of a cylindrical steel vessel with six anodes passing through the cover and a cathode at the bottom. The only gradation which could be arranged on the basis of power and voltage would be to increase the dimensions of the electrodes with increasing current, and to increase the distance between electrodes

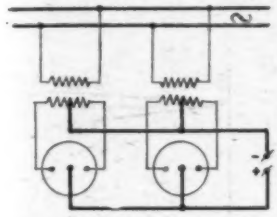


Fig. 1.

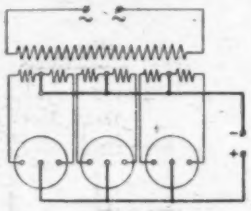


Fig. 2.

with increasing voltage. Experience shows, however, that any saving of material effected in this manner is more than offset by increased cost of manufacture. As a matter of fact, the same spacing of electrodes will serve such a wide voltage range as 65 to 650 volts, and there is little practical advantage in adapting the electrodes to a number of current values. The frequency of the primary A.C. supply has no influence on the rectifier. For these reasons, says Bela Schafer (*Elekt. Zeitschrift*) the Glarus Rectifier Co. has standardised only two sizes of steel-clad rectifier, for 250 and 500 amperes respectively; the D.C. voltage can be arranged to have any value between 110 and 800 volts. Higher current output is

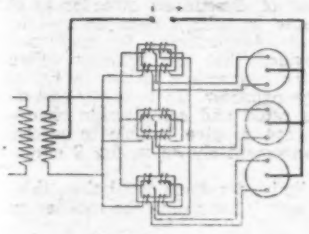


Fig. 3.

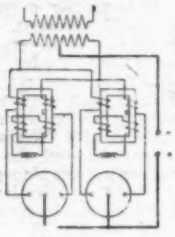


Fig. 4.

obtained by paralleling several rectifiers, and the relative merits of various systems of connection and regulation are discussed in this article.

Parallel operation of several rectifiers offers no particular difficulties. Once the vacuum has been reduced to a permanently low value, the pressure drop in the arc is practically constant at 16 to 18 volts down to the lowest current value. The negative characteristic of the rectifier arc is only slightly in evidence, the voltage drop in the arc increasing by only a volt or two as the current decreases. Hence the requisite ballast may be provided by a small choke coil. There are a number of alternative connections which secure satisfactory current distribution without sacrifice of effi-

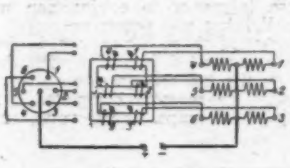


Fig. 5.

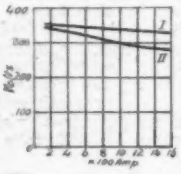


Fig. 6.

ciency or power factor, and the choking coil may be utilised for voltage regulation. If each rectifier be provided with its own transformer, as in fig. 1, the voltage drop of the transformer secures uniform division of load, without the use of a choking coil. Also, this arrangement yields the lowest voltage drop between light load and full load (leaving out of consideration for the present certain special connections which are considered later). The provision of a number of small transformers instead of one large one of the same total capacity involves higher capital outlay, but provides greater security of operation.

Another arrangement which yields satisfactory parallel operation without the use of choke coils is shown in fig. 2, where a number of secondary windings are used in conjunction with a single primary. The stray reactance is a minimum when the load is the same in each current branch, hence there is a tendency for this condition to be maintained automatically. In both cases represented by figs. 1 and 2, a single rectifier or any desired part of the group may be placed in commission. An arrangement which is electrically equivalent to those of figs. 1 and 2 is shown in fig. 3, where uniform current distribution is obtained by choking coils with special auxiliary windings which are not connected in series but short circuited in series; here again, unequal distribution of load between the several rectifiers sets up voltages in the choking coils which re-establish balance. An

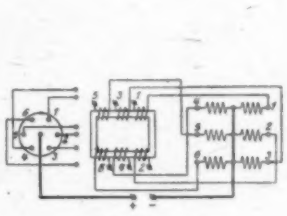


Fig. 7.

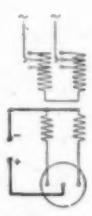


Fig. 8.

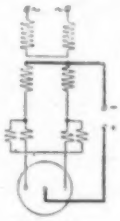


Fig. 9.

equally good result is obtained by the arrangement shown in fig. 4, where the auxiliary windings are not connected in series but short circuited directly on to each choking coil. In all the arrangements so far illustrated, the busbar voltage varies very little if the number of rectifiers in service be proportional to the load. With all the rectifiers in parallel, the total voltage variation from light load to full load is 6 to 10 per cent.

The connections in figs. 1 to 4 are equally applicable to single-phase or polyphase rectifiers, but where six-phase rectifiers are operated in parallel one would (in the interests of economy) wind all six phases on the three limbs of a single core (fig. 5), rather than use six single-phase choke coils. Of the various possible arrangements of six-phase

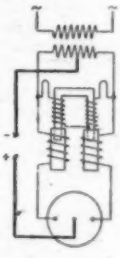


Fig. 10.

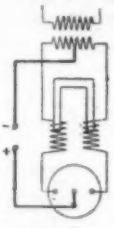


Fig. 11.

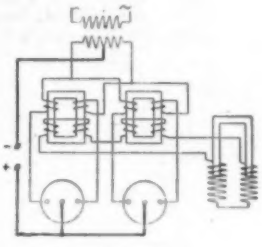


Fig. 12.

choke coils, that in fig. 5 gives the lowest pressure drop. The characteristic feature of this arrangement is that the iron core is magnetised in the same sense by the three successive phase currents, *i.e.*, the magnetisation is nearly sinusoidal. Ballast choke coils without short-circuit windings cause, however, considerable voltage drop, which varies according to the selected choke voltage and the load voltage, between 14 and 20 per cent. The importance of the connections chosen, as regards the parallel operation of several rectifiers, is shown in fig. 6, which refers to a group of three rectifiers for currents up to 1,500 amp. (total) at 320 volts. Curve I shows the voltage-current characteristic with connections as in fig. 2; and curve II relates to fig. 5, with equal transformer voltage and the use of choking coils which absorb 40 volts when traversed by the normal anode current at 50 cycles per second. Higher voltage drop may be desirable if the rectifier is to be operated in parallel with old-fashioned motor generators, but the connections in figs. 1 to 4 are suitable for use where new machines are employed, having small voltage drop between no load and full load. By using a suitable inductive resistance instead of short circuiting the auxiliary windings, the voltage drop of the regulator may be given any desired value between 6 per cent. and 20 per cent., and thus adapted accurately to parallel operation with D.C. dynamos.

Fig. 7 shows an arrangement of anode choking coils for a six-phase rectifier, using only two cores instead of three, as in fig. 5. All six-phase coils magnetise the core in the same direction, so that there is good interlinking and overlapping of effects. The small magnetic leakage between the individual coils ensures good parallel operation with medium voltage drop on the D.C. side.

The parallel connection of choking coils reduces the efficiency by less than 1 per cent., and the same applies to

power factor, except in the case represented by fig. 4, when the power factor is reduced by from 3 to 5 per cent., according to the size of the choking coil. Normally the power factor of the rectifier is from 0.9 to 0.98.

Connections for Voltage Control.—The rigid ratio between the A.C. and D.C. voltage of the rectifier necessitates an alteration in the applied A.C. voltage if the rectified voltage is to be varied. The A.C. voltage may be varied either by altering the number of effective primary or secondary turns in the transformer (fig. 8), or by an auxiliary transformer of variable number of turns or coupling. In the latter case an induction regulator (fig. 9) or a transformer with plunger core (fig. 10) may be used.

In the larger rectifier installations, induction regulators have hitherto been used almost invariably for voltage control. If suitably arranged, the regulator is not affected by the operation of the rectifier, even if it be connected on the low-voltage side and carries only pulsating, rectified current in its windings. In smaller installations, the arrangement shown in fig. 11 may be used, in which voltage regulation

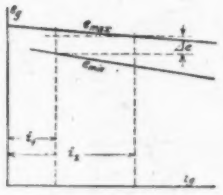


Fig. 13.

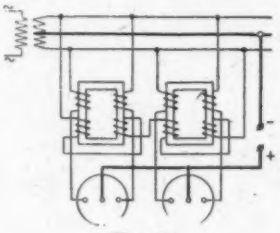


Fig. 14.

is effected by choking coils with plunger cores. This is suitable for charging stations of from 10 to 20 KW., where it is less a matter of maintaining a definite voltage than of limiting the charging current.

Where several rectifiers are to be connected in parallel, it is advantageous to provide the existing anode choke coils with additional windings, and to short circuit the latter through the regulating choing coils, as in fig. 12. This arrangement results in considerable improvement in power factor and in better regulation. The trend of the rectified voltage is shown in fig. 13. Connections as in fig. 11 yield slightly divergent voltage lines; whereas the connections shown in fig. 12 yield curves which are practically parallel (making possible better utilisation of the regulating coil). Fig. 13 shows also that any desired voltage within the range Δe is obtainable between the loads i_1, i_2 corresponding approximately to full load and half-load. The good regula-

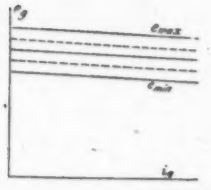


Fig. 15.

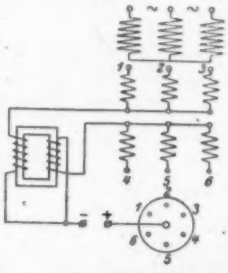


Fig. 16.

tion, small loss, and simplicity of the regulable choking coil make it very suitable for small and medium-sized installations.

The anode choking coils used for the parallel connection of several rectifiers can be used advantageously for voltage regulation by using them in the form of auxiliary transformers (fig. 14), the secondaries of which are in series with the anodes, whilst the primaries are connected to aid or oppose the main transformer. Three voltage steps are thus obtained as shown in fig. 15. The middle step is obtained by short circuiting the primary windings on themselves; the main transformer generally makes possible two voltages in the ratio 1 : 2 which yield another two pressure stages, as shown by the dotted lines in fig. 15. Finally, if desired, a small regulator of the type already described may be used to provide voltages intermediate between the five steps. The efficacy of the anode choking coils as regards parallel working is not reduced by using them as auxiliary transformers.

The connections shown in fig. 16 (due to J. Kubler, of Brown, Boveri & Co.) are interesting in connection with voltage regulation. The two low-voltage windings form two star-connected, three-phase systems displaced 60 deg. in phase. When the rectifier is in action, there flow through the two neutral conductors, undulating currents the direct-current components of which do not magnetise the solenoid choking coil owing to the opposing connections; on the other hand, the ampere-turns of the alternating-current components add together and produce powerful throttling effect. The rectified voltage is almost constant between light load and full load, with a maximum drop of 2 to 3 per cent. The requisite power rating of the choking coil is about 10 per cent. that of the main transformer power.

The system of compounding illustrated by fig. 17 permits the voltage drop to be made zero or, if required, yields a rectified voltage which *increases* with load. The connections employed are an elaboration of those used in fig. 14, a choking coil being connected in series with the winding of the auxiliary transformer and provided with a coil excited by rectified current (see heavy lines, fig. 17). As the load on the rectifier increases, so does the unidirectional saturation of the core of the choking coil, hence there is less throttling effect, and therefore a rise in voltage on the field winding of the auxiliary transformer. The auxiliary voltage (positive or negative, according to the connections adopted) is thus increased, and the curve of rectified voltage lies within the limits shown in fig. 18. The compounding action may be explained in greater detail by reference to fig. 19, in which

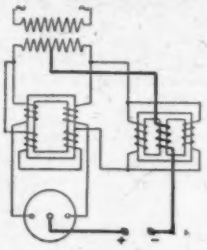


Fig. 17.

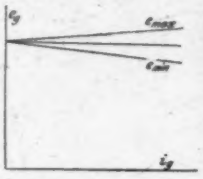


Fig. 18.

the choke-voltage e is shown as a function of the total ampere-turns. If the main current coil carries no current (rectifier on light load) a relatively small alternating current $i\,a$ in the A.C. windings develops a considerable voltage drop, say, a. If, however, the rectifier be loaded, so as to produce a steady saturation of the iron core of the choke coil corresponding to point c (fig. 19), then the same alternating current as before can now produce only a small field variation, say, b. The decrease in choke voltage is therefore in the ratio $a : b$, and the voltage of the auxiliary transformer is correspondingly increased.

It is merely a question of dimensions in order to obtain 10 to 15 per cent. increase in voltage from no load to full load, so as to compensate, for instance, for pressure drop in a long feeder. Provided that the primary voltage is constant or nearly so, the connections shown in fig. 17 replace a high-speed voltage regulator. In tramway and similar service where there are rapid and considerable changes in load, inertia effects are apt to give trouble in mechanical regulators, and the arrangement shown in fig. 9 offers considerable advantages.

As regards the lower limit of voltage regulation, this may be continued to zero without interrupting the rectifier action,

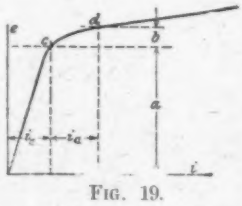


Fig. 19.

provided that the cathode then be excited permanently by an auxiliary arc.

In the municipal electricity works at Hirschberg, there are three mercury rectifiers (one in reserve), each rated at 540 amp., 465 volts. At full load of 500 KW., two rectifiers are in circuit, and these (alone or in conjunction with a storage battery) feed the lighting and power network. Voltage regulation within a range of about 10 per cent. is obtained by an induction regulator connected in series with the six-phase main transformer on the low-voltage side.

Mercury rectifier installations recently completed are said to be capable of yielding 16,000 amps. at 250 volts, and 550 amps. at 1,100 volts.

An Indian Society of Engineers.—The question of the formation of a single engineering association for India, under the auspices of the Home Institutions of Mechanical and Electrical Engineers, has been under consideration at Bombay and Calcutta. An attempt was recently made by Major G. lH. Willis, R.E., of H.M. Mint, Bombay, through a letter to the Indian technical Press, to elicit views on the matter. According to a letter in the *Times of India*, it was resolved, at a meeting held on January 3rd, to call the Society the Indian Society of Engineers. An Organising Committee was appointed. The inaugural meeting was to take place in November, at Delhi. An organising guarantee fund of Rs. 20,000 was raised.

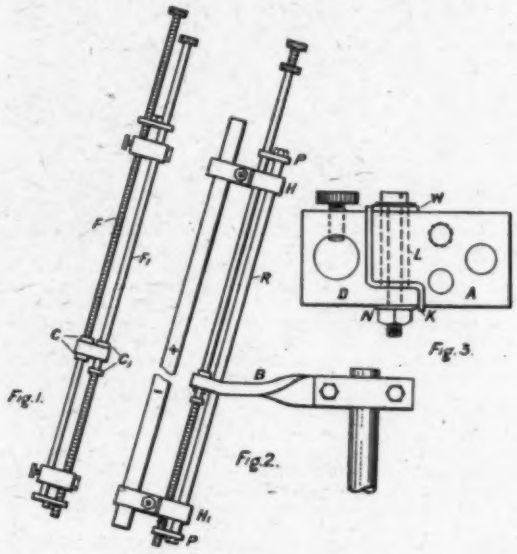
NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Hand-Feed Arc Lamp.

A simple lamp, suitable for lantern work, which can be made up by the aid of ordinary screw-cutting dies, is illustrated by the accompanying drawings (figs. 1, 2, and 3). Besides dispensing with the need of gear-cutting machinery, or the use of left-hand thread, it has the advantages of quick striking, and the ease with which the arc may be centred, by adjusting the carbons independently. The lamp was designed by N. D. Blagdon Phillips, Lieut., R.E., who made one "in the Field" and used it for blue printing.

Fig. 1 is a front view (without the carbons), while fig. 2 is a view in elevation of the complete lamp, in which a rod R, supported by the bracket B, has a bearing plate P at each end. These plates act as bearings for the positive feed rod F and the negative feed rod F_1. Each of these latter has a



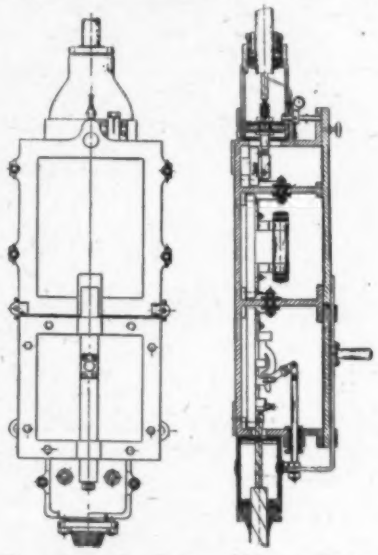
Figs. 1, 2 & 3.—Hand-feed Arc Lamp.

right-hand thread cut on a portion of its length, and collars C and C_1 pinned on them respectively. F is screwed in the positive carbon holder H and passes through a clearance hole in the negative carbon holder H_1, and *vice-versa* in the case of the rod F_1. F and F_1 are turned for feeding purposes by means of the milled disks at the top. The space between the collars C_1 is to allow the negative carbon to be pulled upward about ⅛ in., and pushed down as soon as the arc is struck. Fig. 3 is a larger scale view of the positive carbon holder, in which the two brass pieces A and D are insulated from each other by the fibre strip K, the bush L, and the washer W. The flex may be connected under the washer and nut N.

A New Mining Switch.

The patent gate-end mining switch, of which figs. 4 and 5 show the details, is the joint invention of Messrs. W. Creswick, general manager, and J. Bentham, electrical engineer, of the New Sharlston Collieries, Ltd., near Normanton. This switch was designed for use with all portable machinery underground; it can be used either on D.C. or A.C. circuits, providing these particulars are given at the time of ordering. In designing the switch, it was endeavoured to make it fool-proof, durable, and safe; a large number of these boxes are now in use at the SharlstonCollieries, where, we understand, they have given every satisfaction. The initial cost may be great in the first instance, but taking safety as the first consideration, durability, and low cost of maintenance, they are claimed to be the best in the long run.

The body of the box is formed of a three-compartment casing, housing respectively the switches, fuses, and plug box. The box cover is formed in two parts, which close respectively the switch chamber and the fuse and plug-box chambers. The switches are of the usual quick-make-and-break type, operated by a crank-arm connected to a rod projecting through a gland in the box, the rod being, in its turn, connected to and operated by a bolt which slides in guides on the outside face of the box. If desired, there can be fitted a mitre bolt lock, permitting the switches to be opened, but not closed again without the application of a special key. The fuse bodies are of cartridge form, provided at both ends with metal sockets permanently secured in position, so that the terminals are always in alignment. It is only necessary to remove the two caps to renew the wire, whilst, as the parts are metal, they may be screwed tight without the possibility of stripping. The box itself as well as the compartments within are flame proof.



Figs. 4 and 5.—Gate-end Mining Switch.

The action is as follows, presuming the switch is closed:—Upon the main bolt being drawn the switch will be opened, and when the bolt has moved clear of the lower half of the cover, by easing the thumbscrews the latter can be thrown back on its pivots, thus opening up the fuse and plug chambers. It is impossible to get at a terminal compartment without first opening the fuse compartment and impossible to open the latter without withdrawing the bolt which opens the switches. Further, as the plug is secured in position by a through bolt, the outward movement of which is controlled by the cover, it is impossible to put in or remove the plug till the switches have been opened. The bayonet contacts are carried in a mica-insulated aluminium plate, which slides into a groove at the front end of the box, so that all joints can be made and examined without dismantling the box.

Further particulars can be had from the inventors.

Electric Warehouse Truck.

A new one-ton electric truck, which is specially adapted for use in warehouses and factories owing to the fact that it can turn in a circle of 4 ft., has been brought out by British

Fig. 6.—A New 1-ton Truck.

Electric Vehicles, Ltd., of Churchtown Works, Southport. The truck, illustrated overleaf (fig. 6), has a loading space

6 ft. by 3 ft. 1 in., the platform being 1 ft. 8½ in. from the ground. The speed on the level is 6 to 7 miles per hour, and the rated mileage per battery charge is 20 to 25 miles on the level. The battery consists of fourteen 25-volt cells of the chloride "Ironclad" pattern, with a capacity of 193 ampere hours. The charging rate is 25 to 40 volts, 10 amperes, and boosting charges can be given up to 50 amperes when necessary. The vehicle is fitted with three speeds in either direction, and a bell push is attached to the controller handle. The transmission is by chains from both motors to the rear wheels. The brake, which is of the external expanding pattern to both rear wheels, is operated by a foot pedal, and is normally in the "on" position. A switch is interlocked with the brake, cutting off the current when the brake is on, and *vice versa*.

A New Rotary Transformer.

Our illustration (fig. 7) shows a new patent variable-voltage rotary transformer designed for use in all cases where the voltage of a direct-current supply is required to be transformed in the most efficient possible way. This machine is made by the Crypto Electrical Co., Ltd., Acton Lane, Willesden, N.W.10, where we recently had an opportunity of seeing the machine on the test bed. The machine, we understand from the makers, is intended to take the place of the standard motor generator, and among the various advantages claimed in favour of the rotary are a saving in first cost, weight, space, and efficiency. The single machine has fewer bearings and less parts to get out of order, and it does not require lining up on a level foundation, since it is a self-contained unit.

These machines can be made for various requirements, as, for instance, variable voltage by shunt control for accumulator charging, &c.; constant voltage secondary as a compound motor generator for lighting, &c.; and reverse compounded (drooping characteristic) for arc lighting, kinemas, searchlights, &c., or for electric welding.

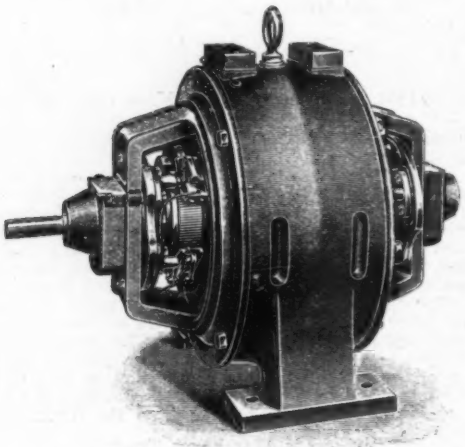


Fig. 7.—A New Variable-Voltage Rotary Transformer.

Readings taken for the machine that we saw on test indicated the following results for the three cases when compounded, reversely compounded, or for variable voltage respectively. The secondary voltage in each case if of particular interest.

	Prim. V.	Prim. A.	Sec. V.	Sec. A.	Revs.	Load.
Compounding	198	33·5	64	80	1,475	Full
	199	4	64	0	1,300	Light
Reverse compounding	200	4·1	63·1	0	1,250	Light
	200	28	51	80	1,220	Full
Variable voltage	200	29	51·2	80	1,180	Low
	200	29	56·5	80	1,275	Normal
	200	33·2	62	80	1,365	Full

Electric Snow-melters for Railway Tracks.—An electric heater has been devised for use on the New York Central Railroad for keeping switches and special work at points free from snow and ice, says the *Electric Railway Journal*. The heater consists of resistance wire wound about a porcelain tube, the whole being enclosed in 3½-in. wrought-iron pipe 20 in. long. The heating units are laid under the points to be protected, and the current is switched on as soon as snow begins to fall. Very satisfactory results have been obtained in a three-years' trial, only one case having occurred in which the snow was not melted as fast as it fell. Each unit takes 11 amp. at 36.7 volts, and for turn-outs with 5-ft. switch points 18 heaters were used, thus taking 7.26 kw. for each turn-out. The heaters have also been employed under pipe runs, signal mechanisms, turn-table pits, and the like.

NATIONAL ELECTRICITY SUPPLY.

The report of the Law Committee of the Association of Municipal Corporations, on electric power supply, which was adopted by the council on January 23rd, 1919, deals with the reports which have been made by the Electrical Trades Committee, the Coal Conservation Sub-committee, and the Electric Power Supply Committee.

After giving an admirable summary of the various recommendations, and particularly the proposals relating to District Electricity Boards, the report proceeds:—

In our opinion, the general principle that the generation of electricity should be subject to the control of a body having authority over a sufficiently large area, where there will be a large and varied demand for energy, is one that should commend itself to the municipalities. The selection of the areas and the determination of the type of board to be established will, no doubt, give rise to some difficulties, but we are glad to note that in the report the view is expressed that it would be a mistake to attempt to tie the hands of the Commissioners, and that it is sufficient to give certain general indications as to the broad lines to be worked along by them, and then to leave them a free hand to deal with the variety and complexity of the situation which they would undoubtedly meet in each district.

As regards the constitution of the boards, we desire to reiterate the view which we expressed a short time ago, and which was accepted by the council, that it would be a mistake to depart from the principle upon which Parliament has acted with very few exceptions for many years past, that undertakings of this description, which involve a monopoly and upon which the prosperity of the people is so largely dependent, should be in the hands of public authorities. We are convinced that in most cases it would be preferable to have boards which are financed locally, and upon which local authorities should have a preponderating voice, due regard being had to the financial responsibility undertaken by the several constituent members.

The report suggests, in paragraphs 58 to 63, that whilst the District Electricity Boards should remain the owners of the undertaking, the operation might be transferred to a commercial company as lessees. We are of opinion that this would be wrong and contrary to the principle referred to in the last paragraph, and that both the ownership of the undertaking and the operation thereof should remain in the hands of the publicly constituted authority. In the report the opinion is expressed (para. 47) that it is essential that the District Electricity Boards should make no divisible profit, and this view, with which we are prepared to acquiesce, appears to us to be inconsistent with the suggestion that the undertakings might be carried on by companies whose primary object would necessarily be to make a profit for their shareholders.

Although the control of the generation of electricity would, according to the proposals, be in the hands of the District Boards, it would not, of course, be proposed to discontinue the use of all the present stations, many of which are well placed and suitably equipped for the generation of energy on a large scale and at a low cost. As regards many stations, it would, no doubt, be true economy that their use should be wholly or partly discontinued, and in those cases the owners should be adequately compensated, so that their financial interests are not prejudiced.

We are of opinion that there are stations which comply with modern requirements and which already serve a wide area and have a large and diversified load, and which consequently might be retained by their present owners and in suitable cases used for affording a supply to larger areas. We are also of opinion that where the undertaking is so situated as not to lend itself to a general scheme of generation and supply, the Electricity Commissioners should exercise a dispensing power either temporary or permanent, and on such conditions as they think fit. The precise course to be adopted in each case is rightly intended by the report to be considered by the Electricity Commissioners and decided by them. We would urge that:—

1. The greatest opportunity should be afforded to local authorities owning generating stations to make representations, and if they think fit to present schemes to the Electricity Commissioners for the constitution of an area and a District Electricity Board.

2. The Act of Parliament to be based upon the report should clearly provide that a municipal corporation already supplying power on a large scale and over a large area, and able and willing to develop that supply at its own risk, should be empowered to do so at its own option, and that its existing area of supply should be extended to such an extent as may be deemed desirable by the corporation and the Commissioners, having due regard to the local requirements of the district.

The basis on which generating stations should be taken over by the district board is generally to be "payment of the actual amount expended on lands, buildings and plant for generating purposes, less depreciation, reserve funds and renewal funds and sinking funds which have been provided and which are properly applicable to the generating stations. Exceptional cases may require special treatment."

We are strongly of opinion that these terms are inequitable and could not be accepted by local authorities. In some cases where a district board is formed to take over the

undertakings of local authorities only, the basis of outstanding debt might not be inappropriate, but in view of the want of uniformity in the practice of local authorities with respect to depreciation, reserve and renewal funds, we think that all such funds, other than statutory sinking funds, should be retained by the individual authorities. The case of those authorities which have carried sums from revenue account to capital account or have written down their capital at a rate in excess of statutory requirement or have met losses out of the rates should receive special consideration. In cases where both local authorities and companies have to be dealt with, the inequality of the proposed basis is greatly accentuated owing to the fact that companies are under no obligation to provide sinking funds.

We suggest that the fundamental consideration is that the transaction contemplated is not a purchase and sale, but the formation of a partnership. The essentials of a basis are therefore:—

1. Fairness between the partners.
2. Avoidance of inflaton of the capital of the partnership.

If these requirements are fulfilled it is not necessary that the basis should be the same in every case. It is suggested accordingly that no attempt should be made to lay down a uniform basis, but that the two essentials already mentioned should be adopted as instructions subject to which the Commissioners should deal with each case. This would leave room for agreements between the parties to whom considerable freedom of action should be left, subject always to the approval of the Commissioners.

We have not criticised the report of the Coal Conservation Sub-committee, because we assume that that report is now superseded by the Electric Power Supply Committee's report. We ought, however, to state clearly that we must not be taken as accepting the conclusions expressed in the former report, and particularly the suggestions that appear in it that company management should take the place of municipal management. On the contrary, in our opinion, the public interests would better be served by precisely the converse process.

Nor must we be taken as accepting the figures contained in the sub-committee's report. Amongst other things, a comparison is made between the average price charged by municipal electricity undertakings in Lancashire and by company undertakings in the north-east coast district of England. As far as we are aware, no evidence was given before this committee, and the figures and the circumstances under which the supplies are given would require careful investigation before they could be accepted as affording a basis for comparison.

THE SUPPLY OF SINGLE-PHASE POWER FROM THREE-PHASE SYSTEMS.

At Edinburgh, on January 14th, Prof. Miles Walker's paper (an abstract of which appeared in our issue of December 13th, 1918) was read and discussed before the Scottish Centre of the Institution of Electrical Engineers.

Mr. Mitchell said that in a reference to the "effect of single-phase load on a three-phase generator" it was stated that if the single-phase load did not exceed 20 per cent. of the normal three-phase load the disturbance to the voltage would be inconsiderable. If that was done regularly up to the full 20 per cent., would there not be considerable heating in the generator due to pulsating fluctuation? In Glasgow single-phase loads were thrown in and off three-phase mains without unbalancing the voltage. This was done in connection with welding transformers, and the same thing was done in an even smaller way for glass annealing. The speaker thought that as systems grew larger the objections against the three-phase furnace would not weigh so heavily. Also, as furnaces grew larger the provision of the rotating balancer would be a very costly item. The right policy was to dissipate energy directly in the furnace as three-phase power rather than by complicating the position by first converting to single phase by rotating machinery. There was undoubtedly a demand for a single-phase supply for electric traction, and that demand would be greatly enhanced if anticipated developments were fulfilled.

Mr. W. B. Hird said that in the balancer described the windings were described as having the single-phase winding locally congregated with two or three phases. He suggested splitting the single-phase slots so that, instead of being integrated with two of the three phases, they would overlap one of the phases. It would look as if such an arrangement would be more easily dealt with. The need for the suggested conversion would be limited to supplies to furnaces or traction loads, and it appeared to him that if that was the only combination requiring such a change, the proportion of the total load on the system thus represented would be small. If a large number of furnaces or cars were run, it was easy to balance them and still keep a fairly efficient balance on a three-phase system. If, on the other hand, the system of supply was large, it could stand a great many furnaces and cars without being put seriously out of balance. With the schemes now in hand for large stations there was little hope that such a scheme of conversion would ever be largely practicable. None of the schemes of conversion described in the paper were really automatic; they required skilful watching in order to make a successful combination. While he much admired the paper from the theoretical point of view, he hoped they would never have to resort to any of the devices described.

Mr. Anslow suggested that they ought to improve the multi-phase furnace rather than devise means of phase conversion.

Prof. Baily described the machine as exceedingly ingenious, and simpler than others evolved in America. He thought the machine would be of considerable use for smaller tramway systems, as it would not want much power, and a convenient tapping from the three-phase main would be necessary and much required. Three phase did not lend itself to conversion into single phase. Would it not be better to convert the three phase to two phase, and on the two phases they had the two actual phases separately pulsating, but they could separate their two phases quite independently. If they made double use of these phases, such as supplying two dynamos, then the out-of-balance load might be taken up by quite a small balancer, working the balancer very much in the way of the ordinary three-wire system. This out-of-balance was taken up by a rotary machine, and not the whole current, as in Prof. Walker's machine. Not only was the balancer taking care of the out-of-balance, but only half of the out-of-balance current. The motor took up half the balance, and the generator the other half, so that a small balancer would take one half of the total load with a very obvious efficiency, as well as a moderate first cost.

Mr. E. Seddon regretted that the author had found it necessary to introduce a rotary balancer. This not only increased the cost of the furnace, but introduced undesirable features from the consumer's point of view. The electric furnace was essentially the class of load for a large station, and most supply engineers who had not yet handled the business would have to provide for it in the near future.

Prof. Miles Walker, in reply, said that where they could divide the single-phase load into two parts that was the best thing to do. The difficulty with furnaces was that they were not all out of or in use at the same time, and they got a load with a variable characteristic. For single-phase furnace work the extra expense in balancing was very small if they had decided to correct their power factor and reduce their voltage. For ordinary three-phase supply it was preferable to divide the system into two phases, and convert the two phases. One reason for using a big distance between single-phase and three-phase windings was to get the necessary reactance. That enabled them also to introduce the compensation winding. They wanted the machine to operate only as a rotating generator. It tended also to operate as a transformer, but if it operated only as a transformer it would not act as a balancer at all. He was sure all small tramway systems would want a balancer of this kind, though he believed it would be better to have a two-phase system, and try to split up the load between the two phases. Stationary machines were admittedly preferable to rotary ones, but to those who used a balancer and got a steady three-phase load, instead of a jerky load on short-circuit, it was worth while to have a rotary machine. So far as consumption was concerned, he did not think the single-phase furnace showed a great saving. The main point was the saving in carbon consumption, and the fact that if they used that method of control they saved lining. In Norway there was a project on foot by which they calculated that they would save £1 per ton by using single-phase furnaces. Single-phase generators driven by water-wheels would be used, and each generator would feed one furnace. On consumption results the operator at Darlington told him that his results showed 600 units per ton, *i.e.*, melting without refining. That figure was perhaps too good. More power was lost through bad management of the furnace than through the characteristics of the system. If preparations were properly made, and there was a switch-off as soon as the metal was melted, the consumption need not exceed, say, 670 units per ton. The motor-generator had two rotating fields instead of one, so that if the rotating field system cost one-third of the machine they might take it they saved about a third more. Then they had two windings for the same cost in the motor-generator. They had a certain amount of saving in iron, so that the balancer was only about 55 per cent. of the cost of the motor-generator, and the efficiency would be about 5 to 6 per cent. higher. They could do everything with the motor-generator that they could do with the balancer.

Priority of Work Order, 1917.—The Ministry of Munitions has suspended the operation of the above Order as from February 1st, 1919, except that from that date priority shall be given to work and materials in accordance with any special directions or regulations issued by the Minister of Munitions.

All priority certificates and permits issued before February 1st, 1919, continue to be operative until March 1st, 1919, but shall cease to be operative on that date.

THE RÖNTGEN SOCIETY.

At a meeting of the Röntgen Society, on February 4th, Dr. F. HERNAMAN-JOHNSON read a paper on protection in X-ray work, more especially with regard to the effects of scattered and secondary rays. He said that the tube should be entirely enclosed in a box opaque to the rays; the diaphragm leaves and lead glass in front of the screen must also be opaque, and the body of the observer must be protected when using the diascope by making the whole front opaque, and when using the couch, by means of a moving panel and extensive flaps of lead rubber attached to the screen.

An interesting discussion took place as to whether metal articles worn by the X-ray worker, such as watches or rings, or even coins in his pocket, could set up injurious secondary radiations. Dr. J. METCALFE, who has had personal experience on this point, said that he had worn a silver wrist-watch within his lead-rubber glove while using X-rays, and an ulcer was set up on the wrist corresponding in size and position to the watch. The remarkable thing was that a thickness of 2 or 3 mm. of leather, comprising the watch band, intervened between the metal and the skin, but even this had not been sufficient to absorb the secondary radiations which were set up in the silver. He had found the same action with nickel sock-suspenders. Dr. HERNAMAN-JOHNSON said that the danger of such articles worn on the person only arose when the protective material surrounding the tube was ineffective. Given proper protective devices for tube and screen, the only personal "armour" which the diagnostician needed when doing X-ray work was a rubber glove for making digital examinations.

At the same meeting Lieut. W. MAKOWER, M.A., D.Sc., described and exhibited a Langmuir exhaust pump, which is used for exhausting some of the modern X-ray tubes. He said that the point about the Langmuir pump was that the walls of the vessel were cooled in the neighbourhood of the nozzle by water circulation, so that the molecules of mercury or other gas which came through on to the surface condensed there by virtue of the fact that the temperature was low, and there remained. In the case of the ejector pump, the temperature had a tendency to rise, so that the molecules got away again in the form of vapour, and thus introduced a contrary action or double blast of mercury, one stream passing downwards and the other upwards, so that long-continued action was not possible. In the case of Langmuir's device there was only a stream in one direction, and the gas, escaping down into the jet by diffusion, was carried away.

A very beautiful experiment was carried out at the meeting whereby in the course of five or ten minutes a small tube was completely exhausted, the glow with which it was suffused at first appearing no longer, and the spark preferring to jump the gap. The pump was described in the ELECTRICAL REVIEW of January 12th, 1917.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

1,861. "Process for recovery of iron from scrap tinned steel." S. O. COWPER-COLES. January 25th.
1,862. "Electro-deposition of iron alloys." S. O. COWPER-COLES. January 25th.
1,873. "Electric cable-carrying or supporting means." A. H. LESSELLS. January 25th.
1,897. "Electrical apparatus for movement duplication or remote control." F. M. DENTON & E. T. PAINTON. January 25th.
1,905. "Guard chambers for holding electric elements." J. NOLAN. January 25th.
1,912. "Electric bell switches." H. M. BLACK. January 25th.
2,109. "Sparking plugs." J. K. WHITE AND BAYNES & PARTNERS. January 28th.
2,121. "Ignition and load control for internal-combustion engines." W. W. BUCHER. January 28th.
2,130. "Electrical discharge-gap apparatus." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. January 28th. (U.S.A., February 8th, 1918.)
2,134. "Electric heating element for raising temperature of solution in electroplating vats." A. BOLTON. January 29th.
2,145. "Variable resistances for electric welding, &c." QUASI-ARC CO. AND A. P. STROHMENGER. January 29th.
2,164. "Electric lamp." M. E. MARSHALL (T. Marshall). January 29th.
2,188. "Sparking plugs." W. SKAM. January 29th.
2,194. "Charging boards for electric accumulators." H. LEITNER & W. H. EXLEY. January 29th.
2,195. "Heating by electricity." R. H. FORMAN & C. O. BASTIAN. January 29th.
2,197. "Electric signalling systems." WESTERN ELECTRIC CO. (Western Electric Co., U.S.A.) January 29th.
2,203. "Dry batteries." J. G. HOSSACK. January 29th.
2,216. "Dynamo battery ignition system." F. H. HOCKING & A. W. PEARSON. January 29th.
2,235. "Fuse and circuit testers." L. D. JOHNSON. January 29th. (U.S.A., April 7th, 1916.)
2,236. "Ignition devices for internal-combustion engines." SPLITDORF ELECTRICAL CO. January 29th. (U.S.A., June 8th, 1918.)
2,243. "Signalling apparatus." S. OLLIANINE. January 29th.
2,244. "Automatic control apparatus." S. OLLIANINE. January 29th.
2,253. "Electric switches." T. W. A. ATTWATER & SOUTHERN TRANSPORT CO. January 29th.
2,254. "Magnetic chucks, &c." A. C. NORMAN & SOUTHERN TRANSPORT CO. January 29th.
2,262. "Electric boiling plates, hot plates, stoves, and ovens." A. J. RICH & A. H. BUNDY. January 29th.
2,269. "Telephonic transmitters." B. S. COHEN. January 29th.
2,270. "Signalling apparatus." B. S. COHEN. January 29th.
2,289. "Apparatus for discovering and determining electrically location of veins of ore or mineral." H. T. F. LUNDBERG & H. J. H. NATHORST. January 30th. (Sweden, July 8th, 1918.)
2,295. "Contact breakers for magnetos." D. C. DINGLEY & G. MAYOR. January 30th.
2,322. "Obtaining single-phase alternating electric currents from three-phase or *vice versa*. A. M. TAYLOR. January 30th.
2,326. "Rotary interrupters for electrical circuits." H. A. EASTMAN. January 30th.
2,329. "Dynamo construction." H. LEITNER. January 30th.
2,361. "Electric lamp sockets." G. FRANKEL. January 30th.
2,366. "Electrical amusement apparatus." S. J. LEVI. January 30th.
2,369. "Electrolytic processes." H. DEBAUGE. January 30th. (France, January 30th, 1918.)
2,370. "Electrolytic apparatus." H. DEBAUGE. January 30th. (France, January 30th, 1918.)
2,377. "Radiotelegraphy." V. BAJENOFF. January 30th.
2,384. "Incandescent electric lamps." T. W. HANCOCK & T. W. HARRINGTON-MOUNTJOY. January 30th.
2,392. "Electric fuses." A. H. MORSE. January 30th.
2,393. "Electrical condensers and mountings therefor." BOSCH MAGNETO CO. January 30th. (U.S.A., February 11th, 1918.)
2,395/6. "Ignition devices for internal-combustion engines." F. A. SMITH. January 30th.
2,423. "Electrical fuses." MIDLAND ELECTRICAL MANUFACTURING CO. AND W. L. BARBER. January 31st.
2,448. "Anti-vibration electric light fittings." F. A. ROSS. January 31st.
2,458. "Electric switch fuses, &c." V. E. JOYCE & PARK ROYAL ENGINEERING WORKS. January 31st.
2,471. "Motor starters, &c." E. N. BRAY, AND BRAY, MARKHAM & REISS. January 31st.
2,484. "Ignition generating devices." E. C. R. MARKS (Splitdorf Electrical Co., U.S.A.). January 29th.
2,485. "Ignition systems." SPLITDORF ELECTRICAL CO. January 31st. (U.S.A., December 28th, 1916.)
2,486. "Generating ignition current." SPLITDORF ELECTRICAL CO. January 31st. (U.S.A., November 9th, 1917.)
2,487. "Generating electric currents." SPLITDORF ELECTRICAL CO. January 31st. (U.S.A., June 8th, 1918.)
2,492. "Switch contacts." F. J. GILL. January 31st.
2,500. "Device for tapping and making temporary connection with insulated electric cables or wires." T. A. ATKINSON, J. MEREDITH & J. M. PETERSON. January 31st.
2,507. "Manufacture of electric accumulators." H. LEITNER & W. H. EXLEY. January 31st.
2,516. "Electric switches." D. B. JONES. January 31st.
2,517. "Apparatus for grinding, &c., commutators for electric motors, &c." J. PHILLIPS. January 31st.
2,522. "Wireless telegraph valves, &c." B. S. GOSSLING & F. HORTON. January 31st.
2,528. "Ignition devices." C. E. PALMER-BOTT. February 1st.
2,536. "Ignition devices of internal-combustion engines." A. W. WALL AND J. WHITE. February 1st.
2,542. "Supporting means for light diffusing shades on electric, gas, &c., lamps." C. H. KITCHING. February 1st.
2,569. "Ignition of internal-combustion engines." C. H. T. ALSTON. February 1st.
2,585. "Electric wave transmission." C. D. EFIRET. February 1st. (U.S.A., February 1st, 1918.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

11,031. ELECTRIC MOTOR-CONTROL SYSTEMS. British Thomson-Houston Co. (General Electric Co., U.S.A.) July 31st, 1917. (121,753.)
16,517. ELECTRICAL ALTERNATING-CURRENT RELAYS. Electric Control, Ltd., and O. Ellefsen. May 10th, 1918. (121,766.)
18,048. VENTILATION OR COOLING OF DYNAMO-ELECTRIC MACHINES. H. Chitty. December 5th, 1917. (121,774.)
18,778. ELECTRIC ARC LAMPS. H. S. A. Rydberg. November 11th, 1916. (112,269.)
19,195. SAFETY DEVICES FOR INTERLOCKING THE OPERATING PARTS OF ENCLOSED ELECTRIC SWITCHGEAR WITH THE DOOR OR DOORS OF THE ENCLOSED CASING. J. A. Hirst & P. S. Brook. December 29th, 1917. (121,939.)
19,239. INTERRUPTERS OR CONTACT-BREAKERS FOR MAGNETO-ELECTRIC MACHINES. R. B. North & A. M. Allen. December 29th, 1917. (121,787.)
19,280. PARTY-LINE RINGING SYSTEMS FOR TELEPHONE EXCHANGES. Western Electric Co. (Western Electric Co., U.S.A.) December 31st, 1917. (121,790.)
19,304. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. L. Lavoisier. December 31st, 1917. (122,000.)

1918.

56. EXCESS-DEMAND ELECTRIC METERS. A. W. Burke. January 2nd, 1918. (121,805.)
183. ELECTRIC LAMPHOLDERS. B. J. Grigsby. January 3rd, 1918. (121,818.)
354. RAILWAY SIGNALLING. Mackenzie, Holland & Westinghouse Power Signal Co. (Union Switch & Signal Co., U.S.A.) January 7th, 1918. (122,000.)
436. ELECTRICAL WALL PLUGS AND THE LIKE FITTINGS. J. R. Craig. January 8th, 1918. (122,010.)
537. ELECTRIC ANTI-OVERHEATING DEVICES FOR ELECTRIC IRONS. J. H. Hickey. January 9th, 1918. (122,022.)
729. ELECTRODE HOLDERS FOR ELECTRIC FURNACES. C. W. Kayser & J. E. Robinson. January 12th, 1918. (122,034.)
748. METAL RECEPTACLES FOR THE ACCUMULATORS OF ELECTRIC BATTERY LAMPS. W. P. Wrightson. January 12th, 1918. (122,035.)
379. TELEGRAPHIC RECEIVING APPARATUS. E. A. Willson. January 7th, 1918. (121,824.)
901. SPARKING PLUGS. H. G. Longford, W. W. Longford & W. A. Clark. January 16th, 1918. (121,835.)
1,003. MACHINE SWITCHING TELEPHONE SYSTEMS. Western Electric Co., G. Deakin & L. Polinkowsky. January 19th, 1918. (122,047.)
1,795. PROTECTING DEVICES FOR ALTERNATING-CURRENT APPARATUS. J. A. Kuyser. January 31st, 1918. (122,057.)
2,757. FIRE-PREVENTION DEVICE FOR ELECTRIC CABLES. Simplex Conduits, Ltd., & J. H. Collie. February 15th, 1918. (122,064.)
2,790. FORM OF MOUTHPIECE FOR USE WITH THE STANDARD FORMS OF TELEPHONE TRANSMITTERS. P. Whysall. February 16th, 1918. (121,852.)
2,878. CARBONISATION AND DISTILLATION OF COAL AND OTHER CARBONACEOUS MATTER BY ELECTRICITY. C. W. Simpson & L. Moorhouse. February 19th, 1918. (121,854.)
3,963. TELEPHONE RECEIVER EARPIECES. A. C. Brown. March 6th, 1918. (121,866.)
4,131. ELECTROMECHANICAL POWER TRANSMISSION SYSTEM. Leyland Motors, Ltd., & J. G. P. Thomas. March 8th, 1918. (121,870.)
4,939. ELECTRIC MOTOR CONTROLLERS. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 20th, 1918. (122,085.)
4,933. VACUUM TUBES. British Thomson-Houston Co. (General Electric Co., U.S.A.) March 20th, 1918. (121,878.)